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CONTRACTOR'S FINAL REPORT

DSS Contract 09SC.KH205-3-0179

ENFOR Project P-294
Review of Commercial and Industrial
Wood/Peat Energy in
Atlantic Canada 1978/83 and Beyond
by
Northland Associates Limited

Contractor: Northland Associates Limited
P.O. Box 1734
St. John's, Newfoundland

Scientific Authority: A.B. Case
Research Manager
Canadian Forestry Service
P.O. Box 6028
St. John's, Newfoundland
A1C 5X8

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November 1984

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APPENDIX 1. INDIVIDUALS PROVIDING INFORMATION
FOR THIS STUDY

1. INTRODUCTION

1.1 Background

Historically, the people living in Atlantic Canada have relied on the forest resource to provide substantial quantities of biomass fuel for domestic, industrial and commercial needs.

Residues from forest resource activities such as sawmills, and pulp and paper have augmented the operation of private and public woodlots in meeting these needs.

Based upon data generated by the wood energy project reports and related information collected for this study, a current estimation of wood biomass utilized as fuel for the region is given as follows:

Province	Estimated annual consumption (green tonnes)		
	Residential	Commercial/ Industrial	Total
New Brunswick	600,000	1,250,000	1,850,000
Nova Scotia	540,000	805,000	1,345,000
Pr. Edward Isld.	154,000	66,000	220,000
Newfoundland	<u>750,000</u>	<u>210,000</u>	<u>960,000</u>
Totals	2,044,000	2,331,000	4,375,000
	(1,022,000 cds)	(1,165,000 cds)	(2,187,500 cds)

Although this study was not required to deal with residential applications it should be recognized that the recent rising trend in domestic conversion to wood fuel is reflected in these estimates. In effect, almost 50% of the estimated wood fuel consumption within the Atlantic Provinces is taken up by the residential sector.

The commercial/industrial sector for this study includes all biomass fuel applications in such installations as pulp and paper mills, sawmills, industrial plants, greenhouses, institutional buildings, district heating systems serving various types of buildings, and other similar applications.

The growth of biomass fuels as a less costly substitute for fuel oil and hydro power has increased steadily in recent years. This is particularly evident in the commercial/industrial sector in Atlantic Canada.

Assisted by government programs and funding, proponents in many existing and new industries and institutions have selected biomass fuel burning technology as a means of holding operating and production costs under control. Annual savings in fuel costs varying from 30 to 80% have been demonstrated in the 109 project applications summarized by this study.

Concern does exist as to the supply of biomass in the long-term. Also, there is an on-going need to assess the global as well as regional impacts of promoting increased dependence upon biomass fuel.

This study was commissioned to gather and summarize the pertinent facts with regard to completed and proposed biomass energy projects in the region.

1.2 Objectives of Study

Objectives of the study are:

- (i) to identify and summarize the commercial and industrial wood/peat energy developments in Atlantic Canada (Newfoundland, Nova Scotia, New Brunswick, Prince Edward Island) for the period 1978-1983.
- (ii) to evaluate the future prospects for wood/peat energy developments in each of the four provinces and in the region as a whole.
- (iii) to identify and summarize proposed future wood/peat energy projects in Atlantic Canada.
- (iv) to provide a comprehensive bibliography of recent literature related to the subject of wood/peat energy (including environmental and resource implications) in Atlantic Canada.

1.3 Methods

The information presented in this report was obtained from field visits to selected developments, from interviews (telephone and in-person), and from a review of printed material. Additional information on each data gathering procedure is presented below.

1.3.1 Field Visits

During the course of the study, field visits were made to the following wood energy applications:

Newfoundland

- Gander Hospital (Gander)
- Abitibi Price Inc. Paper Mill (Grand Falls)

Nova Scotia

- Nova Scotia Forest Industries Ltd. Paper Mill (Port Hawksbury)
- Scott Maritime Ltd. Paper Mill (New Glasgow)
- Scotia Farm Services Ltd. (Kentville)
- Gordon's Greenhouses (Oxford)

New Brunswick

- University of New Brunswick (Fredericton)
- Maritime Forest Ranger School (Fredericton)

Prince Edward Island

- Kings County Memorial Hospital (Montague)
- Montague Junior High School (Montague)
- Royalty Gardens Greenhouse (West Royalty)

While in the field, interviews were held with the individuals directly associated with the projects visited. Also, one conference on wood energy (in Charlottetown, Prince Edward Island) was attended during the field visits.

1.3.2 Interviews

In addition to meeting with project personnel at the sites visited, the field visits also presented an opportunity to interview provincial government personnel and other knowledgeable individuals in each province. However, because of time constraints, many of the interviews were conducted by telephone from St. John's.

1.3.3 Literature Review

Relevant literature was obtained during the field visits, by telephone and written requests, and by library research. All material received was reviewed.

1.3.4 Project Summary Sheets

In consultation with the Scientific Authority, a standard project summary sheet was developed to present the required data on each specific application.

1.3.5 Micro Computer Data Base

An in-house micro computer data base system was used to prepare various tables, summaries and comparison of project profiles.

This permitted each project file to be quickly and accurately updated as information was received.

1.4 Data Limitations

Some difficulties were encountered in obtaining pertinent data for some of the energy applications. While good base information was available on the initiation of a demonstration or operational application, there was a definite lack of follow-up data on results after the implementation stage. Quite often the study team was denied access to information which was considered confidential.

Other data deficiencies are explained in terms of "final report not prepared at this time."

Data for a particular project were often found to be inconsistent, depending upon sources and timing. The report summary format focused on the quantity of biomass, equivalent energy, related costs, economics and environmental aspects.

It was necessary, in order to indicate biomass and oil displaced projections by province, to extrapolate energy equivalent ratios. This was done by considering the probable mix of lower energy fuel such as mill bark, sawdust and hog fuel with higher energy wood chips.

Care should be taken therefore in the use of the summary data because of the data "gaps."

1.5 Acknowledgments

The information necessary for this study was widely disseminated. To gain access to it required the cooperation of many individuals in both levels of government and in the private sector in all four Atlantic Provinces and in Ottawa. Without the support we received from these individuals, we would have very little to report. We would like to offer our sincere gratitude to all who helped us put together this review of commercial/industrial developments.

Appendix 1 contains the names of all of the individuals who provided support and information to the study.

1.6 Definitions and Explanations of Terms Used Throughout This Report

Biomass

In the context of this report biomass refers to all forms of forest residue and peat, which have heat energy content. Hence, biomass fuel, biomass energy, bioenergy are terms used which essentially apply to the same material and which have similar meanings.

Biomass Units

Generally, biomass units used in this report refer to the fuel material in its harvested or residue form, ie. "green" or "wet" state. Because of the usual large quantities and characteristics of this material, little attempt is made to differentiate variables such as constituent species or organic quality, and moisture content. Where possible, reference is made to physical form, eg. roundwood, wood chips, sawdust, peat, bark, etc.

Energy Equivalents

Project summaries used in this report refer to energy equivalents in terms of barrels of oil displaced/tonne of biomass. These values were determined from the reports to range from 0.60 to 1.80, depending upon several factors.

- Quality of species mixture of forest residues. (Energy value varies according to species.)
- Moisture content (M.C.). (Energy values vary in direct proportion to the percentage of moisture present.)
- Grade of oil displaced. Usually bulk furnace oil, either No. 2 or No. 6 grade.
- Efficiency of burner.
- Degree of precision of measurement.

For summary purposes only, the study team has applied "guess-timate" values in equating barrels of oil displaced to tonnes of biomass fuel. Usually this reflected the proportion of wetter materials--bark, sludge, sawdust--to drier, higher energy content wood chips. Also, where possible, these values reflected reported burn test results.

Value Equivalents

The equivalent value of biomass fuel for a given application, is derived from the energy equivalent and the local cost of fuel oil. It should be noted that furnace oil costs vary substantially. Large energy users such as pulp and paper industries purchase furnace oil for \$32-\$35 per barrel. Small industrial/commercial users pay as high as \$60 per equivalent barrel (38¢/litre). For example, assuming an energy equivalent in a biomass application of 1.2 bbls/green tonne where furnace oil cost \$55 bbl, the value equivalent for the biomass is 1.2×55 or \$66/green tonne.

Data Base Reports

Project reports are grouped and summarized to reflect available statistical data. It must be noted that the data system used quite often shows a 0 or 0.00 under such headings as quantity, cost, annual savings, payback, etc. This should be interpreted as "insufficient or no data available to report."

Abbreviations

gr tonne	Green tonne refers to biomass, wood chips, sawmill residue, bark, peat, etc., at approximately 50% moisture content.
BDt	Bone dry tonne also referred to as oven dry tonne (ODt) - wood having a zero moisture content. For summary purposes and "average" conditions $1 \text{ BDt} = 2.0 \text{ green tonnes, and}$ $1 \text{ BDt} = 20.0 \times 10^9 \text{ Joules}$
Bbl	Barrels (oil = 35 Imp. gal. = 158.91 litres)
M.C.	Moisture content for biomass is the fraction or percentage of water content as determined in a laboratory drying oven and calculated on either a dry or wet basis. A wet basis moisture content is used in this report. $\text{M.C. (wet basis)} = \frac{\text{wt of water removed in oven drying} \times 100}{\text{Original wt of wood including moisture}}$
J	Joule unit of heat energy equivalent to .00095 BTU. 1 GJ (gigajoules or 10^9 J) is equivalent to 995,000 BTU.

hog fuel	Refers to forest residue such as bark, etc. which is run through a "hog" at the pulp mill or sawmill before burning as "hog fuel."
F.I.R.E.	Forest Industry Renewable Energy Program administered by Energy, Mines and Resources Canada.
CREDA	Conservation and Renewable Energy Demonstration Agreement. Administered jointly by federal/provincial agencies.

Conversion Factors

1 tonne	2205 pounds (1.023 tons)
1 cubic metre wood	0.4 BDt (approximate)
1 cord wood	2.0 tonnes biomass (approximate)
1 barrel furnace oil	6.15×10^9 Joules
1 BDt	20.0×10^9 Joules (approximate)
1 litre furnace oil	38.7×10^9 Joules
1 litre furnace oil	0.00258 BDt at efficiencies of 80% for oil and 60% for wood at 50% M.C.
1 terajoule	43.0 cords (approximate)

2. COMMERCIAL/INDUSTRIAL WOOD/PEAT APPLICATIONS

This study involved the review of an extensive number of wood energy project reports, related literature and data for the Atlantic Provinces during the period 1978 through March 1984. It is known that the list of projects and applications is not complete and for practical and budgetary reasons it was not possible to obtain complete information within the time frame of this study.

However, for review and summary purposes it is felt that the reports and literature cited provide for a comprehensive overview of what has been happening with respect to applications of wood and peat energy during the period. Subject to "data gaps" in particular areas, meaningful use can be made of the valuable information collected.

It should be emphasized that the precision of the results data for each application is difficult to pin down because it is constantly changing. One of the difficulties encountered in assembling data was the fact that the volumes and values changed with respect to time and source of reporting.

Soon after the study began, it became clear that not all of the wood/peat developments in Atlantic Canada would fit conveniently into just "existing" and "proposed" categories.

Thus, to provide maximum understanding for this study and to facilitate updating, we have classified the projects described in this report as:

- Completed: Project work complete, equipment (if any) installed and operational.
- Incomplete Project at some stage of implementation, may be partially operational.
- Studies and Proposals: Potential wood energy application identified, and receiving serious consideration in the form of feasibility studies.
- Field Trials: Reports of trial operations of equipment or process which may not indicate continuous operation.

The remainder of this section of the report contains summaries of these projects by province and by category. A brief overview precedes the project summaries for each province.

Sources of Information

Very few of the projects described in the remainder of this section have provided information reports for general distribution. The "REPORTS" column of most summary sheets will therefore be blank. If a report or "information package" is available, addresses for obtaining these will be given at the beginning of each provincial sub-section.

2.1 NEW BRUNSWICK

Completed Projects (23 applications reported)

The 23 applications reported utilize an estimated 623,400 green tonnes of biomass fuel annually. This amount of fuel displaces approximately 657,200 barrels of oil giving an average energy equivalent of 1.05 bbls of oil/green tonne of biomass. Assuming an average cost of \$36.00 per barrel of oil, this represents \$23,659,200 in oil energy displaced by biomass fuel.

By far the greatest quantity of biomass fuel is applied in pulp and paper, and related sawmill operations. Major pulp and paper users include:

MacMillan Rothesay	St. John	250,000 gr tonnes
Irving Pulp and Paper	St. John	71,460 gr tonnes
Fraser Inc.	Edmundston	40,000 gr tonnes

Major sawmill and wood manufacturing applications include:

Northwood	Chatham	131,600 gr tonnes
Fraser Inc.	Plaster Rock	26,000 gr tonnes
George Burchill	Miramichi	18,000 gr tonnes
Irving	Juniper	18,000 gr tonnes

A large district heating system located on the campus of University of New Brunswick uses an estimated 42,500 green tonnes of biomass fuel.

Other smaller commercial/industrial and institutional users account for the remaining 24,000 tonnes or 4% of the total.

Incomplete Projects

(10 applications reported)

These projects will utilize an estimated 1,230,345 green tonnes of biomass fuel annually. This quantity of fuel is expected to displace approximately 1,147,095 barrels of fuel oil giving an average energy equivalent of 0.93 bbls/green tonne. Using an estimated average cost of \$36.00 per barrel of oil, this represents \$41,295,420 in oil energy displaced by biomass fuel.

Major users of biomass fuel when these projects are completed are the pulp and paper industries.

Irving Pulp and Paper	St. John	490,000 gr tonnes
Boise Cascade	Newcastle	320,000 gr tonnes
Fraser Inc.	Atholville	306,000 gr tonnes
C.I.P. Inc.	Dalhousie	108,000 gr tonnes

These major users will account for over 99% of the total incomplete project applications.

All of these major projects utilize biomass as an energy source for the manufacture of pulp and paper. Primarily mill bark and associated waste material are mixed with wood chips or hog fuel from local sawmills, and burned in waste

wood-fired furnaces to produce steam and electricity. Recent emphasis is to promote harvesting residues from the pulp logging operation by chipping and transporting waste material previously left in forest areas.

Studies

(4 projects reported)

If carried into the implementation stage these studies would contribute toward the additional annual harvesting of an estimated 159,520 green tonnes of forest and wood residues. Assuming an average energy equivalent ratio of 1.20 bbls/gr tonne, this would displace approximately 191,400 bbls having an estimated 1984 value of \$1,656,000 (at \$40.00 per barrel of oil).

Representative of these studies is a biomass wood residue study for the Miramichi River watershed. It is understood that wood fuel produced will be directed toward industrial, commercial, institutional and residential markets.

This review indicates that most of the large pulp and paper industry applications for wood energy have been completed. The direction of current planning and studies is toward integration of forest industries with various potential users of biomass supplied economically from forest and industrial residues.

Neill Gunter (1983) suggests that in a given market area (Kings and Queens Counties), it may be reasonable to project the conversion of 15% industrial/agricultural potential users, and only 5% of commercial/institutional users to wood energy.

Trials

(1 project reported)

University of New Brunswick demonstration of various methods of producing, drying and distributing forest biomass as wood chip heating fuel. No results data were made available for this review.

Sources of Information

CREDA Summary Sheets for New Brunswick projects are available from:

Energy Secretariat
P. O. Box 6000
Fredericton, NB
E3B 5H1

2.1.1

NEW BRUNSWICK - COMPLETED PROJECTS

WOOD/PEAT ENERGY PROJECT REPORT SUMMARIES

PROPONENT	LOCATION	FUEL	QUANTITY gr t	COST/ gr t	Bbls OIL DISPLACED	Bbls OIL /gr t	\$ VALUE /gr t	ANNUAL SAVINGS	PAYBACK
ACADIA FOREST PROD	MIRAMICHI	HOG	2800	0.00	2857	1.02	0.00	0	0.0
BELLEISLE SCHOOL	SPRINGFIELD	WOODCHIPS	544	26.10	716	1.32	40.49	20000	6.7
BETH SHALOM INC	ARTHURETTE	WOODCHIPS	251	15.79	327	1.30	66.79	12800	6.0
BROOKDALE NURSERIES	NEWCASTLE	WOODCHIPS	1306	38.28	2286	1.75	61.25	30000	2.9
COOP KEDGEWICK	KEDGEWICK	WOODCHIPS	100	0.00	100	1.00	0.00	0	0.0
FINNIGAN GREENHOUSE	ROGERSVILLE	SANDUST	1000	0.00	900	0.90	0.00	0	0.0
FLAKEBOARD CO LTD	ST. STEPHEN	SHAVINGS	5600	0.00	7000	1.25	60.00	0	0.0
FRASER INC	EDMUNSTON	HOG	40000	0.00	36000	0.90	35.00	0	0.0
FRASER INC	PLASTER ROCK	SHAVINGS	26000	0.00	32500	1.25	43.75	0	0.0
GEO BURCHILL	MIRAMICHI	SHAVINGS	18000	0.00	22500	1.25	43.75	0	0.0
IRVING	JUNIPER	SHAVINGS	18000	0.00	22500	1.25	43.75	0	0.0
IRVING PULP & PAPER	ST JOHN	HOG	71460	0.00	79400	0.90	0.00	0	0.0
LOCKWOOD IND	SCUDOUIC	SHAVINGS	1000	0.00	1250	1.25	50.00	0	0.0
MACMILLAN ROTHESAY	ST. JOHN	HOG	250000	0.00	225000	0.90	35.00	0	0.0
MAR FOREST RANGER SC	FREDERICTON	WOODCHIPS	1400	8.75	1430	1.02	35.70	22750	2.2
MADEAU & MADEAU	ST FRANCOIS MAB	SHAVINGS	2400	0.00	3000	1.25	50.00	0	0.0
NORTHEAST ENERGY SER	CHATHAM	SANDUST	2000	0.00	1800	0.90	62.50	0	0.0
NORTHWOOD PULP	CHATHAM	SHAVINGS	131600	0.00	164500	1.25	43.75	0	0.0
SERRES CO-OP	ROGERSVILLE	SANDUST	1800	0.00	1620	0.90	62.50	0	0.0
SPRUCE ARBOR LTD	SUSSEX	WOODCHIPS	4000	0.00	5000	1.25	60.00	0	0.0
ST LOUIS COLLEGE	EDMUNSTON	SANDUST	726	2.72	843	1.16	43.04	29270	2.8
TABISINTAC GRIMMSES	TABISINTAC	ROUNDWOOD	900	0.00	1080	1.20	60.00	0	0.0
UNIV N B	FREDERICTON	HOG	42500	26.31	44623	1.05	40.43	600000	4.0
** TOTAL **			623387		657232				

PROJECT: Acadia Forest Products

LOCATION: Nelson-Miramichi, NB

PROPONENT: Acadia Forest Products

OBJECTIVE: To lower heating cost and reduce dependency on high priced oil

FUNDING: F.I.R.E. \$ 24,811
Proponent: 234,889

STATUS: Completed

COSTS: Capital cost \$259,700

SYSTEM:

BENEFITS: 2,857 bbls oil displaced

FUEL:

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS:

PROJECT: Wood Chip Heating. Project report on the application of wood heating for a school building, New Brunswick. 1983.

LOCATION: Springfield, Kings Co., NB

PROPONENT: Dept. of Education
Belleisle Regional High School

OBJECTIVE: Demonstrate viability of commercial wood heating plant.

FUNDING: Can/NB \$85,000.
Dept. Education 49,500.

STATUS: Construction completed

COSTS: Capital and Installation: \$122,500.
Monitoring: 12,000.
Wood costs: \$26.10/gr tonne

SYSTEM: Wood chip fired boiler rated at 15 boiler hp.

BENEFITS: Annual fuel savings of \$20,000. Simple pay-back period of 6 years.

FUEL: 716 bbls No. 2 oil displaced by 544 tonnes gr wood chips.
Energy equiv.: 1.32 bbls/gr tonne (2.64 bbls/BDt).
Value equiv.: \$40.49/gr tonne (80.98/BDt).

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: n/a

REPORTS: CREDA Project Summary No. 2043, May 1983.

PROJECT: Wood Chip Boiler - Project report on the application of wood residue as alternative fuel for institution, New Brunswick.

LOCATION: Arthurette, NB.

PROPONENT: Beth Shalom Inc.

OBJECTIVE: Demonstrate that fuel oil consumption can be significantly reduced by burning wood chips for an institutional building.

FUNDING: Can/NB \$65,000.
Beth Shalom 20,000.

STATUS:

COSTS: Capital and Installation: \$82,050.
Monitoring 2,950.
Wood costs: 15.79/gr tonne

SYSTEM: Wood chip fired boiler, hot water heating and circulation.

BENEFITS: Annual fuel savings of \$13,440 through oil reduction.

FUEL: 251 green tonnes wood chips displaced 327 bbls oil. Energy equiv.: 1.30 bbls/gr tonnes (2.60 bbls/BDt)
Value equiv.: \$66.79/green tonne*

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: n/a

REPORTS: CREDA Project Summary No. 2046.

*This data considered inaccurate.

PROJECT: Wood chip burner - project report on the application of alternative wood chip fuel to heat greenhouse buildings, New Brunswick. 1982.

LOCATION: Newcastle, NB

PROPONENT: Brookdale Nurseries Ltd.
Mr. Lloyd Brown

OBJECTIVE: Demonstrate the effectiveness of retrofitted wood chip burner in a greenhouse.

FUNDING: Can/NB: \$58,273
Proponent: 38,848

STATUS: Installation completed

COSTS: Capital: \$86,756
Monitoring: 10,365

BENEFITS: Fuel savings \$30,000, more secure fuel supply, utilizes wood residues, increases employment, payback 2.9 years

FUEL: 1,306 green tonnes wood chips displace 2,286 Bbls oil.
Energy equiv.: 1.75 Bbls/gr tonnes (3.50 Bbls/BDt)
Value equiv.: \$61.25/green tonne

SYSTEM: Portable chipper, chip storage, automatic feed, chip burner (dutch oven), blower/dryer.

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: n/a

REPORTS: CREDA Project Summary No. 2024, July 1982.

PROJECT: La Cooperative D'Age D'Or

LOCATION: Kedgwick, NB

PROPONENT: La Cooperative D'Age D'Or

OBJECTIVE: To lower heating cost and reduce dependency on high priced oil

FUNDING: F.I.R.E. \$ 3,196
Proponent 12,784

STATUS: 100% complete

COSTS: \$15,980

SYSTEM:

BENEFITS: 100 bbls oil displaced

FUEL:

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS:

PROJECT: Wood burning for greenhouse. Application of wood waste burning to heat greenhouse in New Brunswick. 1978.

LOCATION: Rogersville, NB

PROPONENT: Finnigan Greenhouse

OBJECTIVE: Provide economic fuel heat for commercial greenhouse

FUNDING:

STATUS: Completed

COSTS:

SYSTEM: Fire tube design, 3 pass, rated 100 hp.

BENEFITS:

FUEL: Sawdust, sawmill wastes, chipped slabs

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: No data

REPORTS:

PROJECT: Wood waste burning operation. Wood manufacturing industry.

LOCATION: St. Stephen, NB

PROPONENT: Flakeboard Co. Ltd.

OBJECTIVE:

FUNDING: N/A

STATUS: Complete, operational.

COSTS: N/A

SYSTEM: N/A

BENEFITS:

FUEL: Shavings (wood manufacturing residues)
Annual consumption: 5,600 green tonnes
Projected energy equiv.: 1.25 bbls oil/gr tonne
Value equivalent: \$60.00/green tonne

ENVIRONMENTAL: N/A

CURRENT RESULTS: N/A

REPORTS:

PROJECT: Wood waste burning operation. Pulp and paper industry.

LOCATION: Edmundston, NB

PROPONENT: Fraser Inc.

OBJECTIVE:

FUNDING: N/A

STATUS: Completed, operational

COSTS: N/A

SYSTEM: N/A

BENEFITS:

FUEL: Hog fuel. Annual consumption, 40,000 green tonnes displaces estimated 36,000 bbls oil.
Projected energy equiv.: 0.90 bbl/gr tonne
Projected value equiv.: \$35.00/gr tonne

ENVIRONMENTAL: N/A

CURRENT RESULTS: N/A

REPORTS:

PROJECT: Wood waste burning operation. Sawmill industry.

LOCATION: Plaster Rock, NB

PROPONENT: Fraser Inc.

OBJECTIVE:

FUNDING: N/A

STATUS: Completed, operational.

COSTS: N/A

SYSTEM: N/A

BENEFITS:

FUEL: Shavings (sawmill residue).
Annual consumption: 26,000 green tonnes
Projected energy equiv.: 1.25 bbl/gr tonne
Projected value equiv.: \$43.75/gr tonne

ENVIRONMENTAL: N/A

CURRENT RESULTS: N/A

REPORTS:

PROJECT: Wood waste burning operation. Sawmill industry.

LOCATION: Miramichi, NB

PROPONENT: George Burchill and Son

OBJECTIVE:

FUNDING: N/A

STATUS: Completed, operational.

COSTS: N/A

SYSTEM: N/A

BENEFITS:

FUEL: Shavings (sawmill residue)
Annual consumption: 18,000 green tonnes
Projected energy equiv.: 1.25 bbl/gr tonne
Projected value equiv.: \$43.75/gr tonne

ENVIRONMENTAL: N/A

CURRENT RESULTS: N/A

REPORTS:

PROJECT: Wood waste burning operation, sawmill industry

LOCATION: Juniper, NB

PROPONENT: Irving

OBJECTIVE:

FUNDING: N/A

STATUS: Completed, operational.

COSTS: N/A

SYSTEM: N/A

BENEFITS:

FUEL: Shavings (sawmill residue)
Annual consumption: 18,000 green tonnes
Projected energy equiv.: 1.25 bbl/gr tonne
Projected value equiv.: \$43.75 gr tonne

ENVIRONMENTAL: N/A

CURRENT RESULTS: N/A

REPORTS:

PROJECT: Irving Pulp and Paper

LOCATION: St. John, NB

PROPONENT: Irving Pulp and Paper

OBJECTIVE: To lower heating cost and reduce dependency on high priced oil

FUNDING:	F.I.R.E.:	\$ 187,400
	Proponent:	1,686,600

STATUS: 100% completed

COSTS: Capital cost \$1,874,000

SYSTEM:

BENEFITS: 79,400 bbls oil displaced

FUEL:

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS:

PROJECT: Wood waste burning, manufacturing industry.

LOCATION: Scoudouc, NB

PROPONENT: Lockwood Industries

OBJECTIVE:

FUNDING: N/A

STATUS: Completed, operational

COSTS: N/A

SYSTEM: N/A

BENEFITS:

FUEL: Shavings (wood manufacturing residues)
Annual consumption: 1,000 green tonnes
Projected energy equiv.: 1.25 bbl/gr tonne
Projected value equiv.: \$50.00

ENVIRONMENTAL: N/A

CURRENT RESULTS: N/A

REPORTS:

PROJECT: Wood waste burning, pulp and paper industry

LOCATION: Rothesay (St. John) NB

PROPONENT: MacMillan Rothesay

OBJECTIVE:

FUNDING: N/A

STATUS: Completed, operational

COSTS: N/A

SYSTEM: N/A

BENEFITS:

FUEL: Hog fuel (mill wastes, forest residues)
Annual consumption: 250,000 green tonnes
Projected energy equiv.: 0.90 bbl/gr tonne
Projected value equiv.: \$35.00 green tonne

ENVIRONMENTAL: N/A

CURRENT RESULTS: N/A

REPORTS:

PROJECT: Wood Chip Boiler - Maritime Forest Ranger School. A 100-hp Matheson boiler, chipper, dry chip bin, conveyor, chip dryer, and air steam chip feed to boiler.

LOCATION: Fredericton, New Brunswick

PROPONENT: Maritime Forest Ranger School (U.N.B.)

OBJECTIVE: To demonstrate the renewable energy technology by making modifications to an existing wood chip boiler system for increased efficiency.

FUNDING: Canada/New Brunswick: \$39,450
Maritime Forest Ranger School: \$13,150

STATUS: Completed

COSTS: Capital: \$50,100
Monitoring: 2,500

SYSTEM: Recirculated water from condensate-return tank through oil-fired backup system.

BENEFITS: 700 cords of top-grade wood at a cost of \$35,000 per year. Replaced by a 50-50 mix of slabs and cull roundwood at a total cost of \$12,250, resulting in an annual savings of \$22,750 and a payback of 2.2 years.

FUEL: Low grade fuel wood \$34/cord (chipped), and saw mill slabs 12/cord (chipped)
1,400 green tonnes displaces 1,430 bbls oil
Energy equiv.: 1.02 bbls/green tonnes (2.04 BDt)
Value equiv.: \$35.70/green tonne

ENVIRONMENTAL: Not being monitored. General observation - no apparent stack problems.

CURRENT RESULTS: There is a 30% saving in fuel costs.

REPORTS: CREDA Project Summary No. 2013.

PROJECT: Wood waste burning operation

LOCATION: St. Francois Madawaska, NB

PROPONENT: Nadeau and Nadeau

OBJECTIVE:

FUNDING: N/A

STATUS: Completed, operational

COSTS: N/A

SYSTEM: N/A

BENEFITS:

FUEL: Shavings
Annual consumption: 2,400 green tonnes
Projected energy equiv.: 1.25 bbl/gr tonne
Projected value equiv.: \$50.00/gr tonne

ENVIRONMENTAL: N/A

CURRENT RESULTS: N/A

REPORTS:

PROJECT: Wood waste burning operation

LOCATION: Chatham, NB

PROPONENT: Northeast Energy Services

OBJECTIVE:

FUNDING: N/A

STATUS: Completed, operational.

COSTS: N/A

SYSTEM: N/A

BENEFITS:

FUEL: N/A. Assumed hog fuel
Annual consumption: 2,000 green tonnes
Projected energy equiv.: 0.90 bbl/gr tonne
Projected value equiv.: \$62.50/gr tonne

ENVIRONMENTAL: N/A

CURRENT RESULTS: N/A

REPORTS:

PROJECT: Wood waste burning operation, sawmill industry

LOCATION: Chatham, NB

PROPONENT: Northwood Pulp

OBJECTIVE:

FUNDING: N/A

STATUS: Completed, operational

COSTS: N/A

SYSTEM: N/A

BENEFITS:

FUEL: Shavings (sawmill residue)
Annual consumption: 131,600 gr tonnes
Projected energy equiv.: 1.25 bbl/gr tonne
Projected value equiv.: \$43.75/green tonne

ENVIRONMENTAL: N/A

CURRENT RESULTS: N/A

REPORTS:

PROJECT: Wood waste burning operation

LOCATION: Rogersville, NB

PROPONENT: Serres Co-op.

OBJECTIVE:

FUNDING: N/A

STATUS: Completed, operational

COSTS: N/A

SYSTEM: N/A

BENEFITS:

FUEL: N/A. Assumed hog fuel.
Annual consumption: 1,800 green tonnes
Projected energy equiv.: 0.90 bbls/gr tonne
Projected value equiv.: \$62.50/green tonne

ENVIRONMENTAL: N/A

CURRENT RESULTS: N/A

REPORTS:

PROJECT: Wood waste burning operation, nursery

LOCATION: Sussex, NB

PROPONENT: Spruce Arbrer Ltd.

OBJECTIVE:

FUNDING: N/A

STATUS: Completed, operational

COSTS: N/A

SYSTEM: N/A

BENEFITS:

FUEL: Wood chips.
Annual consumption: 4,000 green tonnes
Projected energy equiv.: 1.25 bbl/gr tonne
Projected value equiv.: \$60.00/green tonne

ENVIRONMENTAL: N/A

CURRENT RESULTS: N/A

REPORTS:

PROJECT: Sawdust Burner. Project report on the application of alternative wood waste energy to heat college building, New Brunswick. 1982.

LOCATION: Edmunston, NB

PROPONENT: College Saint-Louis Maillet
Normand Carrier

OBJECTIVE: Demonstrate effectiveness of using sawdust as energy supply to convert heating system in institutional residence building.

FUNDING: Can/NB \$15,000; College \$71,261.

STATUS: Completed.

COSTS: Capital \$81,261; Monitoring \$5,000; Sawdust cost \$2.76/gr tonne.

SYSTEM: Existing central heating plant waste wood fired. Install piping and heat exchangers.

BENEFITS: Annual fuel savings \$29,270, payback 2.8 years

FUEL: 843 bbls. fuel oil displaced by 726 gr tonnes sawdust. Energy equivalent: 1.16 bbl/gr tonne (1.92 bbl/DB tonne). Value equivalent: \$43.04/gr tonne.

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: n/a

REPORTS: CREDA Project Summary No. 2021, June 1982.

PROJECT: Wood waste burning operation, greenhouse

LOCATION: Tabusintac, NB

PROPONENT: Tabusintac Greenhouses

OBJECTIVE:

FUNDING: N/A

STATUS: Completed, operational.

COSTS: N/A

SYSTEM: N/A

BENEFITS:

FUEL: Roundwood
Annual consumption: 900 green tonnes
Projected energy equiv.: 1.20 bbls/gr tonne
Projected value equiv.: \$60.00/gr tonne

ENVIRONMENTAL: N/A

CURRENT RESULTS: N/A

REPORTS:

PROJECT: Conversion to wood burning boiler - Press release on the application of wood waste burning to centrally heat university buildings. New Brunswick. 1983.

LOCATION: Fredericton, New Brunswick

PROPONENT: Northeast Energy Services Ltd.

OBJECTIVE: Convert to boiler which will effectively and economically utilize wood waste fuel (bark and sawdust).

FUNDING: EMR/Can.: \$535,000

STATUS: Completed

COSTS: Capital \$2,400,000
Wood costs: \$26.31

SYSTEM: Design and install wood burning boilers to replace two oil-fired central heating plant boilers, utilize existing steam distribution system.

BENEFITS: Annual fuel savings \$600,000 Utilize locally supplied wood wastes. Eliminate dependency upon imported oil fuel. Payback 4 years.

FUEL: 42,500 green tonnes displaces 44,623 bbls oil.
Energy equiv.: 1.05 bbl/gr tonne (2.10 bbl/BDt)
Value equiv.: \$40.43/green tonne

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: No data

REPORTS:

2.1.2

NEW BRUNSWICK - INCOMPLETE PROJECTS

WOOD/PEAT ENERGY PROJECT REPORT SUMMARIES

PROONENT	LOCATION	FUEL	QUANTITY gr t	COST/ gr t	Bbls OIL DISPLACED	Bbls OIL /gr t	\$ VALUE /gr t	ANNUAL SAVINGS	PAYBACK
BOISE CASCADE	NEWCASTLE	HOG	320000	0.00	325000	1.02	0.00	0	0.0
C.I.P. INC	DALHOUSIE	HOG	108000	0.00	108000	1.00	0.00	0	0.0
CAN ASSOC MENT RETRD	WOODSTOCK	WOODCHIPS	45	4.40	69	1.53	56.73	2335	9.0
EIKE FUTTER	PORT ELGIN	WOODCHIPS	0	0.00	207	0.00	0.00	0	0.0
FRASER INC	ATHOLVILLE	HOG	165000	0.00	166000	1.00	0.00	0	0.0
FRASER INC	ATHOLVILLE	HOG	141000	0.00	141000	1.00	0.00	0	0.0
HOPITAL D'EDMUNSTON	EDMUNSTON	HOG	3000	0.00	3740	1.25	0.00	0	0.0
IRVING PULP & PAPER	ST JOHN	HOG	490000	0.00	399360	0.81	0.00	0	0.0
NADANASKA CORR CENT	NADANASKA	WOODCHIPS	500	14.09	943	1.92	118.09	52000	5.0
ROYAL GARDENS LTD	SUSSEI	WOODCHIPS	2800	0.00	2776	1.00	0.00	0	0.0
** TOTAL **			1230345		1147095				

PROJECT: Boise Cascade Ltd.

LOCATION: Newcastle, NB

PROPONENT: Boise Cascade

OBJECTIVE: To lower heating cost and reduce dependency on high priced oil

FUNDING: F.I.R.E. \$1,713,000
Proponent 6,852,000

STATUS: 78% completed.

COSTS: \$8,565,000

SYSTEM:

BENEFITS: 325,000 bbls oil displaced

FUEL:

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: No data

REPORTS:

PROJECT: C.I.P. Inc.

LOCATION: Dalhousie, NB

PROPONENT: C.I.P. Inc.

OBJECTIVE: To lower heating cost and reduce dependency on
high priced oil

FUNDING: F.I.R.E. \$1,400,980
Proponent 15,749,020

STATUS: 90% completed.

COSTS: \$17,150,000

SYSTEM:

BENEFITS: 108,000 bbls oil displaced

FUEL:

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS:

PROJECT: Wood chip heating. Project report on the application of wood chip burning to heat industrial/institutional building, New Brunswick. 1982.

LOCATION: Woodstock, NB.

PROPONENT: Canadian Association for Mentally Retarded. Mr. Don Allen.

OBJECTIVE: Demonstrate practicability of wood chip burning forced air furnace for industrial/institutional building.

FUNDING: Can/NB \$22,000; Woodstock Community Industries \$22,000.

STATUS: 50% completed (1982).

COSTS: Capital \$20,500; Monitoring \$1,500; Wood chips \$4.40/gr tonne.

SYSTEM: Conventional wood furnace, automatic feed hopper, electric duct heater backup.

BENEFITS: Annual fuel savings \$2,355. Supports local wood supply industry. Demonstrates similar applications may be viable. Estimated simple payback 9 years.

FUEL: 69 bbls. fuel oil displaced by 45 tonnes wood chips. Energy equivalent: 1.53 bbls/gr tonne (3.06 bbls/BD tonne). Value equivalent: \$56.73/gr tonne (\$113.46 BD tonne).

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: n/a.

REPORTS: CREDA Project Summary No. 2014, July 1982

PROJECT: Eike Futter

LOCATION: Port Elgin, NB

PROPONENT: Eike Futter

OBJECTIVE: To lower heating cost and reduce dependency on high priced oil

FUNDING: F.I.R.E.: \$12,200
Proponent: 67,800

STATUS: 54% complete

COSTS: Capital cost \$80,000

SYSTEM:

BENEFITS: 207 bbls oil displaced

FUEL:

ENVIRONMENTAL No environmental monitoring

CURRENT RESULTS:

REPORTS:

PROJECT: Fraser Inc.

LOCATION: Atholville, NB

PROPONENT: Fraser Inc.

OBJECTIVE: To lower heating cost and reduce dependency on high priced oil

FUNDING: F.I.R.E. \$2,519,600
Proponent:

STATUS: 90% complete

COSTS: Capital cost: \$13,640,000

SYSTEM:

BENEFITS: 166,000 bbls oil displaced

FUEL:

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS:

PROJECT: Fraser Inc.

LOCATION: Atholville, NB

PROPONENT: Fraser Inc.

OBJECTIVE: To lower heating cost and reduce dependency
on high priced oil

FUNDING: F.I.R.E.: \$ 2,231,600
Proponent: 27,966,400

STATUS: 90% complete

COSTS: Capital cost \$30,198,000

SYSTEM:

BENEFITS: 141,000 bbls oil displaced

FUEL:

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS:

PROJECT: Hopital Reg D'Edmundston

LOCATION: Edmundston, NB

PROPONENT: Hopital Reg D'Edmundston

OBJECTIVE: To lower heating cost and reduce dependency
on high priced oil

FUNDING: F.I.R.E.: \$174,000
Proponent: 696,000

STATUS: Initiated

COSTS: Capital cost \$870,000

SYSTEM:

BENEFITS: 3,740 bbls oil displaced

FUEL:

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS:

PROJECT: Irving Pulp and Paper

LOCATION: St. John, NB

PROPONENT Irving Pulp and Paper

OBJECTIVE: To lower heating cost and reduce dependency
on high priced oil

FUNDING: F.I.R.E.: \$ 2,860,596
Proponent: 23,117,854

STATUS: 26% complete

COSTS: Capital: \$25,978,450

SYSTEM:

BENEFITS: 339,360 bbls oil displaced

FUEL:

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS:

PROJECT: Wood Chip Burner - Project report on the application of biomass/wood chip technology to heat a correctional centre in New Brunswick. 1982.

LOCATION: Madawaska County, NB

PROPONENT: Dept. Supply and Services, NB

OBJECTIVE: Utilize wood chips as a source of fuel to provide for the heating and domestic hot water requirements of one of the province's correctional centres.

FUNDING: Can/NB: \$170,000
Proponent: 99,000

STATUS: Fifty percent completed

COSTS: Capital and installation: \$262,000.
Monitoring: 7,000.
Wood chip costs: 14.09
gr tonne

SYSTEM: Boiler capable of burning sawdust, wood chips, wood shavings or wood waste (M.C., 20-50%). Output at full firing - 50 bhp. Fire tube type heat exchanger, 3 pass, low pressure, low temperature boiler. Underfed combustion cell with under and overfire air providing combustion.

BENEFITS: Reduction in No. 2 fuel oil. Increased employment in the woods handling industry. Increase in the size of the wood chips market. Provision of a work program for the inmates of the institution. Expected simple payback period 5 years.

FUEL: 943 barrels No. 2 fuel oil displaced by 500 tonnes of wood chips. Savings - \$52,000. Energy equivalent: 1.92 bbls/gr tonne (3.84 Bdt). Value equivalent: \$118.09/gr tonne.

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: n/a

REPORTS: CREDA Project Summary No. 2006, November 1982

PROJECT: Royal Gardens Ltd.

LOCATION: Sussex, NB

PROPONENT: Royal Gardens Ltd.

OBJECTIVE: To lower heating cost and reduce dependency on high priced oil

FUNDING: F.I.R.E. \$ 27,060
Proponent: 129,790

STATUS: Initiated

COSTS: Capital cost \$156,850

SYSTEM:

BENEFITS: 2,776 bbis oil displaced

FUEL:

ENVIRONMENTAL No environmental monitoring

CURRENT RESULTS:

REPORTS:

2.1.3 Studies and Proposals

Studies

NEW BRUNSWICK - STUDIES

WOOD/PEAT ENERGY PROJECT REPORT SUMMARIES

PROponent	LOCATION	FUEL	QUANTITY gr t	COST/ gr t	Bbls OIL DISPLACED	Bbls OIL /gr t	\$ VALUE /gr t	ANNUAL SAVINGS	PAYBACK
ENERGY SECRETARIAT	MIRAMICHI	WOODCHIPS	95520	0.00	119400	1.25	56.25	0	0.0
ENERGY SECRETARIAT	NEW BRUNSWICK	WOODCHIPS	5000	0.00	6000	1.20	0.00	0	0.0
ENERGY SECRETARIAT	NEW BRUNSWICK	WOODCHIPS	9000	0.00	9500	1.06	0.00	0	0.0
ENERGY SECRETARIAT	NEW BRUNSWICK	BIOMASS	50000	0.00	56500	1.13	0.00	0	0.0
** TOTAL **			159520		191400				

Proposals

NEW BRUNSWICK - PROPOSALS

WOOD/PEAT ENERGY PROJECT REPORT SUMMARIES

PROponent	LOCATION	FUEL	QUANTITY gr t	COST/ gr t	Bbls OIL DISPLACED	Bbls OIL /gr t	\$ VALUE /gr t	ANNUAL SAVINGS	PAYBACK
** TOTAL **			0		0				

PROJECT: Biomass-Wood Residue Study. 1983

LOCATION: Miramichi River Watershed, NB

PROPONENT: Energy Secretariat, NB

OBJECTIVE: Determine economic availability of forest harvesting residues within given forest area.

FUNDING: Can/NB: \$78,785

STATUS: Initiated

COSTS: \$78,785 (study costs)

SYSTEM:

BENEFITS:

FUEL: Potential for displacement of 119,400 bbls oil by harvesting and burning forest residues

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS: CREDA Project Summary No. 2045, April 1983

PROJECT: Hardwood/softwood residues as biomass

LOCATION: New Brunswick

PROPONENT: Energy Secretariat

OBJECTIVE: Demonstrate that integrated production into standard harvesting is economic and provides silvicultural benefits.

FUNDING:

STATUS: Study

COSTS:

SYSTEM:

BENEFITS:

FUEL: Estimated 6,000 bbls oil displaced by approximately 5,000 gr tonnes forest biomass wood chips.

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: Confidential

REPORTS:

PROJECT: Integrated Harvesting/Residue Production

LOCATION: New Brunswick

PROPONENT: Energy Secretariat

OBJECTIVE: Demonstrate residue produced from submarginal stands is economic and reduces silvicultural costs

FUNDING:

STATUS: Study

COSTS:

SYSTEM:

BENEFITS:

FUEL: Estimated 9,500 bbls oil displaced by approximately 9,000 green tonnes forest residue, wood chips

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: Confidential

REPORTS:

PROJECT: Infrastructure Feasibility Study

LOCATION: New Brunswick

PROPONENT: Energy Secretariat

OBJECTIVE: Demonstrate by economic models, viability of regional wood energy industry

FUNDING:

STATUS: Study

COSTS:

SYSTEM:

BENEFITS:

FUEL: Estimated 56,500 bbls oil displaced by approximately 50,000 green tonnes biomass

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS: Research, Productivity Council)*See bibliography
Neill and Gunter 1983)

2.1.4

NEW BRUNSWICK - FIELD TRIALS

WOOD/PEAT ENERGY PROJECT REPORT SUMMARIES

PROponent	LOCATION	FUEL	QUANTITY gr t	COST/ gr t	Bbls OIL DISPLACED	Bbls OIL /gr t	\$ VALUE /gr t	ANNUAL SAVINGS	PAYBACK
FOREST RESOUR UMB	FREDERICTON	WOODCHIPS	0	0.00	0	0.00	0.00	0	0.0
** TOTAL **			0		0				

PROJECT: Fuelwood Chip Harvesting - Project report on methods of harvesting and producing forest biomass for industrial and residential use. New Brunswick. 1982.

LOCATION: Fredericton, NB

PROPONENT: Forest Resources Department, UNB

OBJECTIVE: Demonstrate several methods of producing, drying and distributing forest biomass as heating chips.

FUNDING: Can./NB: \$225,000
UNB 45,450

STATUS: Complete

COSTS: Capital and investigative: \$270,450.

SYSTEM: Construction and installation of wood-chip storage facility with blow dryer. Area harvested, 8 one-quarter acre wood lots. Design and construction of a wood chipper.

BENEFITS: Lower individual and institutional fuel costs. Increase local employment and economic activity in forestry, manufacturing and service sectors. Improved balance of payments. Improved management possibilities.

FUEL:

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: No data

REPORTS: CREDA Project Summary No. 2023, November 1982

2.2 NEWFOUNDLAND

Completed Projects

(5 applications reported)

These five applications utilize an estimated 206,310 green tonnes of biomass fuel annually. It is estimated that 175,442 barrels of oil are displaced thus indicating an average barrel of oil equivalent (BOE) of 0.85 bbls/green tonne. Assuming an average cost of \$35.00 per barrel of oil this represents \$6,140,470 in oil energy displaced annually by biomass fuel.

More than 98% of the biomass volume consumed is contributed by two large pulp and paper mill operations. Both Abitibi-Price at Grand Falls, and Bowater Newfoundland Ltd. at Corner Brook mix mill bark with wood chips and other wood waste to produce steam used in the production of newsprint.

At Abitibi-Price a small amount (500 tonnes) of peat was combined with other biomass fuels in 1983. This is expected to be increased to 1,500 tonnes in 1984.

Incomplete Projects

(4 applications reported)

Completion of these projects will increase the annual biomass fuel consumption by approximately 14,000 green tonnes. Projected oil displacement is 18,000 barrels.

Over 25 small commercial and industrial sites are involved in these projects. Small wood chip burning furnaces are installed in new or existing buildings serving a variety of functions.

One large project involves the conversion of a wood manufacturing plant to biomass fuel. The Newfoundland Hardwoods Plant in Clarenville will displace an estimated 14,286 barrels of oil with 11,500 green tonnes of sawmill residues and wood chips.

Chipping/Harvesting Trials (15 applications reported)

Extensive work has been done in Newfoundland over the past six years to develop productive methods of wood chip harvesting. Various equipment and work force combinations have been tried under separate and distinct field conditions. In most cases the wood chips were transported to the pulp and paper mills at Grand Falls or Corner Brook to be burned with mill bark as a fuel supply.

Generally the results of these trials demonstrated that forest residues can be effectively and economically harvested if field conditions and transportation costs are controlled. Importantly, it has been demonstrated that no excessive disruption of ground conditions results from such harvesting techniques.

One major peat recovery project has been undertaken by Noval Industries in Bishop's Falls. This has demonstrated that high volume harvesting based on European technology can be successful.

Studies and Proposals

(9 applications reported)

The Department of Mines and Energy has completed a wood energy infrastructure study for the Bonavista Peninsula which has determined the availability of an abundant biomass supply in proximity to several important industries which are high consumers of oil energy. Among potential conversion candidates are a fish plant in Catalina and a clay brick plant in Milton.

Similarly, other industrial applications are being proposed for detailed feasibility studies in other parts of the island.

In remote communities dependent upon diesel-powered electrical generators, biomass fuel substitutions are being studied. Such applications in Roddickton and Trepassey are now under active consideration. At Trepassey the biomass source is bogland peat fuel. It is proposed that steam and electricity will be co-generated to serve a fish plant and to feed into the power grid.

The future of pulp and paper industries in Newfoundland could very well depend upon the expanded use of biomass fuel in providing cheaper energy. The new paper mill at Stephenville is being studied for the addition of chipped forest residues to the mill bark burner.

Successful implementation of applications under active study in Newfoundland could add an estimated 122,844 green tonnes biomass fuel per year which would displace approximately 127,543 barrels of oil.

Sources of Information

ENFOR Project Reports are available from:

Newfoundland Forest Research Centre
P. O. Box 6028
St. John's, Newfoundland
A1C 5X8

CREDA Project Summaries available from:

Department of Mines and Energy
P. O. Box 4750
St. John's, Newfoundland
A1C 5T7

Internal Reports available from:

Forest Products Development Division
Department of Forest Resources
and Lands
4 Herald Avenue
Corner Brook, Newfoundland
A2H 4B4

2.2.1

NEWFOUNDLAND - COMPLETED PROJECTS

WOOD/PEAT ENERGY PROJECT REPORT SUMMARIES

PROponent	LOCATION	FUEL	QUANTITY gr t	COST/ gr t	Mb/s OIL DISPLACED	Mb/s OIL /gr t	\$ VALUE /gr t	ANNUAL SAVINGS	PAYBACK
ABITIBI-PRICE INC	GRAND FALLS	HOG/CHIPS	101500	0.00	81100	0.79	25.43	0	0.0
BOWATER NFD LTD	CORNER BROOK	HOG	101399	22.43	89143	0.87	26.23	305333	0.0
JOHN LLOYD LTD	BAIE VERTE	WOODCHIPS	116	35.00	143	1.24	74.52	4585	3.5
NATURAL ENTERPRISES	BUTTS POND	WOODCHIPS	95	35.00	111	1.17	70.55	1280	10.0
PATON MEN HOSPITAL	BANDER	WOODCHIPS	3200	30.00	4945	1.54	70.00	100000	9.3
** TOTAL **			206310		175442				

PROJECT: Wood waste burning operation. Current results for wood waste burning in a large pulp mill. Newfoundland. 1983.

LOCATION: Grand Falls, Newfoundland

PROponent: Abitibi Price Inc.

OBJECTIVE: Continuation of wood waste burning to supplement production of steam at reduced cost.

FUNDING: Proponent

STATUS: Operational

COSTS: Wood chips \$33.06/green tonne
Hog fuel: 22.04/green tonne
Peat: 18.00/green tonne
Mill bark: Not recorded

SYSTEM: Wood waste burning furnace steam boiler. Debarking and chip handling.

Utilizes mill bark otherwise requiring expensive disposal. Promotes silviculture benefits in forest lands. Produces steam at saving when compared with oil-fired. Promotes development of peat supply and hogged fuel businesses.

FUEL: Estimated 75,000 green tonnes mill bark; 21,000 green tonnes wood chips; 5,000 green tonnes hog fuel and 500 tonnes peat displace 81,100 bbls heavy furnace oil.
Energy equiv.: 0.79 bbls/gr tonne (1.58 bbls/BDt)
Value equiv.: \$25.43 green tonne

ENVIRONMENTAL: Stack emissions being monitored. Prov. Dept. of Consumer Affairs and Environment are reviewing results. Concerns raised as to particulate emissions.

CURRENT RESULTS:

REPORTS:

PROJECT: Wood waste burning operation. Current results for large pulp mill operation, Newfoundland, 1983.

LOCATION: Corner Brook, NF

PROPONENT: Bowater Newfoundland Ltd.

OBJECTIVE: Continuation of wood waste burning to supplement production of steam at reduced cost.

FUNDING: Proponent

STATUS: Operational

COSTS: Wood chips \$39.00/green tonne (projected from trials). Mill bark: not recorded.

SYSTEM: 1) Morbark 22" chipper, 3 skidders, container trucks, existing bark feeder at mill.
2) Integrated full tree operation using Koehring feller-forwarder, Hahn processor, mobile chipper, container trucks to mill.

BENEFITS: Combining wood chips from forest residues with bark burning at mill, substantially raised the efficiency and energy equivalent of the biomass fuel from .55 bbls/green tonne to .87 bbls/green tonne.

FUEL: 20,399 green tonnes wood chips added to approximately 81,000 green tonnes bark displaces 89,143 bbls No. 6 oil.
Energy equiv.: .87 bbls/green tonne
Value equiv.: \$26.23/green tonne (combined mixture).

For wood chips only, where estimated marginal energy equivalent (when added to bark) is 1.93 bbl/green tonne, the value equivalent is \$57.86/green tonne.

ENVIRONMENTAL: Air pollution due to emission of particulates increased by quantity of chips burned. Provincial Environmental Department monitoring.

CURRENT RESULTS: As reported.

REPORTS: ENFOR Project P-191

PROJECT: Commercial Wood Chip Heating (small commercial). Project report on the application of wood chip heating for small apartment building, Newfoundland. 1983.

LOCATION: Baie Verte, Newfoundland.

PROPONENT: John Lloyd Ltd.

OBJECTIVE: Demonstrate a woodchip heating system used to heat an eight-unit apartment building.

FUNDING: CREDA: \$6,860
Proponent 9,390

STATUS: Completed

COSTS: Capital: \$16,250
Monitoring 3,000

SYSTEM: 250,000 BTU/hr. Svemo gasifier oven, chip container and chip screw, refractory lined tunnel, wood furnace or boiler.

BENEFITS: Reduction in annual heating costs of at least 50% or \$4,585. Payback 3.5 years.

FUEL: 116 green tonnes wood chips displace 143 bbls oil.
Energy equiv.: 1.24 bbls/gr tonnes (2.46 bbl/BDt)
Value quiv.: \$74.78/green tonne

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS: CREDA Report Summary

PROJECT: Commercial Woodchip Heating (small commercial).
Project report on the application of woodchip heating of a small greenhouse operation. Newfoundland. 1984.

LOCATION: Butt's Pond (near Gambo).

PROPONENT: Island Energy Associates Ltd.
Natural Enterprises

OBJECTIVE: Demonstrate a woodchip heating system used to heat a greenhouse.

FUNDING: Proponent: \$5,940
CREDA 6,860

STATUS: Completed

COSTS: Capital \$12,800
Monitoring 3,000

SYSTEM: 250,000 BTU Svemo preheater gasifier interconnected with a wood/oil combination air furnace.

BENEFITS: Reduction of annual heating expenses by 24%
annual savings (mixed wood/oil) \$1,280.
Payback 10 years.

FUEL: 95 green tonnes costing \$35/green tonne, displaces 55 bbls oil.
Energy equiv.: 1.17 bbl/gr tonne (2.34 bbl/BDt)
Value equiv.: \$70.55 green tonne

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS: CREDA report (preliminary) 20 March 1984.

PROJECT: Wood fired boiler. Project report on the application of wood waste burning to heat a hospital in Newfoundland. 1982.

LOCATION: Gander, Newfoundland

PROPONENT: James Paton Memorial Hospital

OBJECTIVE: Demonstrate technical and economic feasibility of burning wood residue and whole tree chips to replace oil currently required for steam production at the hospital.

FUNDING:

Canada (CREDA):	\$642,800
Nfld. (CREDA):	160,700
Newfoundland (Depts. Health/Forest Resources and Lands)	142,500

STATUS: Completed.

COSTS:

Capital cost:	\$934,000
Monitoring:	12,000
Wood cost:	30/green tonne
Operating costs:	
Wood:	96,000
Engineer	20,000
	<u> </u>
	\$116,000

SYSTEM: 2 MW burner capacity (Lamb Cargate Wet Cell Burner) single phase waste heat type boiler (Kewanee) steam distribution at 10⁰ pascals (150 psi).

BENEFITS: Annual fuel savings \$100,000. Supports local wood waste and logging industry.

FUEL: 3,200 green tonnes displace 4,945 bbls Bunker C.
Energy Equiv.: 1.54 bbls/green tonne (3.08 bbl/BDt).
Value Equiv.: \$70.08/green tonne

ENVIRONMENTAL: Monitoring by Prov. Dept. Consumer Affairs and Department of Environment

CURRENT RESULTS: Reflected in above values.

REPORTS: CREDA Project Report No. 03:04:02, October 1982
ShawMont Environmental Assessment SMR-23-Oct. 1980.

2.2.2

NEWFOUNDLAND - INCOMPLETE PROJECTS

WOOD/PEAT ENERGY PROJECT REPORT SUMMARIES

PROONENT	LOCATION	FUEL	QUANTITY gr t	COST/ gr t	Dols OIL DISPLACED	Dols OIL /gr t	\$ VALUE /gr t	ANNUAL SAVINGS	PAYBACK
DEPT MINES & ENERGY	20 SITES	WOODCHIPS	1994	45.00	2572	1.29	74.94	59700	8.9
MINES ENERGY NFLO	VARIOUS	WOODCHIPS	400	45.00	316	1.29	74.95	11980	4.7
NFLO HARDWOODS LTD	CLARENVILLE	WOODCHIPS	11500	30.13	14286	1.24	45.65	178480	3.7
MALKEN ENTERPR	ST JOHNS	SHAVINGS	477	18.00	525	1.10	44.23	12500	4.4
** TOTAL **			14371		17899				

PROJECT: Wood Chip Heating (Domestic) - Project report on the application of wood-waste burning to provide residential heating in rural Newfoundland. 1982.

LOCATION: 20 sites, Newfoundland.

PROPONENT: Dept. Mines and Energy (Newfoundland)

OBJECTIVE: Demonstrate the advantages of chipping waste wood and using it in place of fuel oil or conventional roundwood for home heating.

FUNDING:

Canada (CREDA):	\$572,057
Nfld. (CREDA):	118,014
Homeowners:	30,000

STATUS: 20 applications

COSTS:

Capital:	\$531,316
Fuel costs:	29,378
Monitoring	30,000

SYSTEM: Gravity feed preheater "Firefly," conventional wood furnace or boiler

BENEFITS: Annual fuel savings \$19,850
Supports local industry

FUEL: 997 wood chips displace 1,286 bbls furnace oil.
Energy Equivalent: 1.29 bbls/gr tonne
(2.58 bbls/BDt).
Value Equivalent: \$74.94/green tonne

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: No data

REPORTS: CREDA Project Report Summary No. 03:04:30, October 1982

PROJECT: Wood Chip Heating (small commercial) -
Project report on the application of wood
waste burning to heat selected sites, New-
foundland. 1982.

LOCATION: Various - Newfoundland

PROPONENT: Dept. Mines and Energy (Newfoundland)

OBJECTIVE: Demonstrate advantages of chipping waste wood
and using it to provide low grade commercial
heat.

FUNDING: Canada (CREDA): \$42,742
Nfld. (CREDA): 10,686
Proponent: 9,000

STATUS: Initiated

COSTS: Consulting: \$26,028
Capital: 36,400

SYSTEM: Auger-fed preheater (Svemo model by B.D.R.,
Mississauga, Ontario). 250,000 BTU/hr boiler.

BENEFITS: Reduction in dependency on oil and electric
heating. Increases market for wood chips.

FUEL: 400 tonnes wood chips/sawdust, displacing 516
bbls furnace oil. Energy equivalent: 1.29
bbls/green tonne (2.58 bbls/BDt). Value
equivalent: \$74.95/green tonne.

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS: CREDA Project Summary 02:04:30, October 1982

PROJECT: Conversion to wood fuel. Project report on the conversion of a hardwoods plant to wood fuel. Newfoundland. 1983.

LOCATION: Clarenville, NF

PROPONENT: Newfoundland Hardwoods Ltd.

OBJECTIVE: Replace burning of 500,000 gals (14,286 bbls) oil with wood burning system using locally-produced green wood chips

FUNDING: Proponent: \$325,000
CREDA: 196,600
Other sources: 162,500

STATUS: Under construction

COSTS: Capital: \$650,000

SYSTEM: New 300 h.p.; 10,000 lb/hr, 150 psi steam boiler, and related material handling for wood chip fuel operation.

BENEFITS: Estimated annual fuel savings \$127,500. Pay-back 5.1 years. Promotes local wood chip supply industry.

FUEL: Estimated 11,500 green tonnes wood chips will displace 14,286 bbls oil.
Energy equiv.: 1.24 bbls/gr tonnes (2.48 bbl/BDt)
Value equiv.: \$41.14/green tonne

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: Provincial Government recently contributed special grant of \$100,000.

REPORTS: Wood Energy Infrastructure Project. Acres Consulting Services, 1983.*

* See bibliography

PROJECT: Small Industrial/Commercial Wood Burning System - Project Report on the application of waste wood burning to heat building of timber truss manufacturer. Newfoundland. 1981.

LOCATION: St. John's, Newfoundland.

PROPONENT: Walken Enterprises
CREDA

OBJECTIVE: Demonstrate potential for economic and technical feasibility of such application in Newfoundland.

FUNDING: Proponent: \$27,300
CREDA: 33,700

STATUS:

COSTS: Capital: \$55,000
Monitoring: 6,000

SYSTEM: Batch loading waste wood-fired furnace and hot air distribution.

BENEFITS: Estimated annual fuel saving \$12,500
Simple payback 4.4 years
Demonstrates potential for many similar applications.

FUEL: 477 green tonnes wood waste @ \$18/gr tonne displaces 525 bbls oil.
Energy Equiv.: 1.10 bbl/gr. tonne (2.20/BDt).
Value Equiv.: \$44.23

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS: CREDA Report 571:06:03:04:23. 3 June 1981.

2.2.3

NEWFOUNDLAND - FIELD TRIALS

WOOD/PEAT ENERGY PROJECT REPORT SUMMARIES

PROPOSER	LOCATION	FUEL	QUANTITY gr t	COST/ gr t	Bbls OIL DISPLACED	Bbls OIL /gr t	\$ VALUE /gr t	ANNUAL SAVINGS	PAYBACK
ABITIBI-PRICE	GRAND FALLS	WOODCHIPS	14610	26.64	16071	1.10	32.56	86491	0.0
ABITIBI-PRICE INC	GRAND FALLS	WOODCHIPS	26000	24.00	28571	1.10	27.34	115000	1.2
ABITIBI-PRICE INC	GRAND FALLS	WOODCHIPS	6880	12.39	8900	1.18	17.12	32542	0.0
ABITIBI-PRICE INC	GRAND FALLS	WOODCHIPS	9763	26.47	10153	1.04	22.21	-41590	99.0
ABITIBI-PRICE INC	GRAND FALLS	WOODCHIPS	5700	18.30	7000	1.22	25.95	43605	0.0
BOWATERS WFLD	CORNER BROOK	WOODCHIPS	8158	42.07	9871	1.21	36.30	0	0.0
FOREST PROD DEV (NF)	MILLERTOWN	WOODCHIPS	120	34.20	155	1.29	32.00	-200	99.0
FOREST PROD DEV (NF)	LEWISPORTE	WOODCHIPS	8600	47.06	13416	1.56	46.80	-2236	99.0
FOREST PROD DEV (NF)	GLENWOOD	WOODCHIPS	461	112.27	553	1.20	35.52	0	99.0
FOREST PROD DEV (NF)	HALLS BAY	ROUNDWOOD	1282	5.58	1538	1.20	35.53	0	0.0
FOREST PROD DEV (NF)	MINT BROOK	WOODCHIPS	878	46.50	1133	1.29	41.62	-8642	99.0
LORNE COLLINS	HARE BAY	ROUNDWOOD	420	40.66	470	1.12	63.08	9416	0.0
NOVAL TECHNOLOGIES	BISHOPS FALLS	PEAT	500	0.00	400	0.80	25.60	0	99.0
SOUTHERN AVALON DEV	ST. SHOTTS	PEAT	100	0.00	0	0.00	0.00	0	0.0
** TOTAL **									
			83472		98231				

PROJECT: Whole Tree Chipping Project. Consultant's report on chipping trials at Abitibi Price, Newfoundland. 1983.

LOCATION: Grand Falls, Newfoundland

PROPONENT: Abitibi Price

OBJECTIVE: Demonstrate harvesting, chipping, delivery and burning hardwoods as alternative to Bunker C oil in newsprint mill, Grand Falls. Facilitate unloading of wood chips at mill by installing truck dump mechanism.

FUNDING: Canada (CREDA):
NF (CREDA):
Abitibi Price:

STATUS: Completed

COSTS: 1982 \$279,726
Wood chips at mill \$26.64/green tonne

SYSTEM: Morbark 22 Chiparvester, TJ230 skidders, chain saws, Hydro AX Model 411, tandem dump trucks.

BENEFITS: Wood chips from pulpwood cutover areas, economically harvested and delivered to mill.

FUEL: 14,610 green tonnes woodchips displaced
16,071 bbls Bunker C oil.
Energy equiv.: 1.1 bbls green tonnes (2.2 bbls/DBt)
Value equiv.: \$32.56/green tonne

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS: Whole tree chipping project, June 1981 - Mar. 1983. Abitibi Price Inc., Dept. of Mines and Energy, Highlands Contracting Ltd.

PROJECT: Integrated Logging for Production of Pulpwood and Hog Fuel. Newfoundland. 1981.

LOCATION: Grand Falls, Newfoundland

PROPONENT: Abitibi-Price Inc.
ENFOR (Wilton, Northland Associates Ltd.)

OBJECTIVE: Develop operational techniques for combined harvesting of sawlogs, pulpwood and fuelwood in mixed wood and softwood stands. Assess technical and economic feasibility of integrated logging of stands in the vicinity of Grand Falls. Assess physical impact of integrated logging and complete tree removal on the site, and on the development of the future crop.

FUNDING:

STATUS: Completed.

COSTS: Trial costs \$258,419.
Wood costs \$26.47/green tonne

SYSTEM: Manual felling, skidders, Morbark 22 Chip-
arvester, 22 tonne tractor trailers.

BENEFITS: Trial produced hogged fuel at a loss due to
combination of factors.

FUEL: 9,763 green tonnes displaces 10,153 bbls oil
Energy equiv.: 1.04 bbls/gr tonne (2.0 bbls/BDt)
Value equiv.: \$22.21/green tonne

ENVIRONMENTAL: Generally favourable

CURRENT RESULTS: Increase in oil cost would produce savings.

REPORTS: ENFOR Project P-143

PROJECT: Whole Tree Chipping for Fuel. Project report on the application of wood waste burning for a large newsprint mill. Newfoundland. 1982.

LOCATION: Grand Falls, Newfoundland

PROPONENT: Abitibi-Price Inc.

OBJECTIVE: Demonstrate harvesting, chipping, delivery, and burning of hardwoods as alternative fuel to Bunker C oil in newsprint mill. Facilitate mill site unloading of woodchips by installation of truck dump mechanism.

FUNDING: Canada (CREDA): \$109,520
Nfld. (CREDA): 27,380

STATUS: Completed

COSTS: Capital: \$136,900
Operating cost: 595,000
Wood cost:
26,000 tonnes @ \$24.00 /green tonne

SYSTEM: Harvesting: woodcutters, Timberjacks, Morbark 22 Chipper, dump trucks, and tractor.

Fuel dumped in storage yard. Existing pneumatic conveyor takes fuel to existing wood-fired furnace.

BENEFITS: Annual fuel savings \$115,000. More efficient handling of chip trucks at mill. Creates 12 jobs. Payback 1.2 years.

FUEL: 26,000 green tonnes displaces 28,571 bbls No. 6 oil.
Energy equiv.: 1.10 bbl/gr tonne (2.20 bbl/BDt)
Value equiv.: \$27.34/green tonne

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS: CREDA Project Summary No. 03:04:29. October, 1982.

PROJECT: Whole Tree Chips - An Experimental Fuel Supplement. Application of harvesting/chipping techniques to produce wood chip fuel for large pulp operation. Newfoundland. 1979.

LOCATION: Grand Falls, Newfoundland

PROPONENT: Abitibi-Price
Forest Products Development (Department Forest Resources and Lands)

OBJECTIVE: Evaluate the feasibility of utilizing non-commercial species as an oil replacement.

FUNDING:

STATUS: Completed

COSTS: Contract cost \$156,000.
Wood chip cost: Not available

SYSTEM: Skidding modified Timberjack RW 30's and Choker Skidders Morbark 22 Chiparvester. Dump truck to mill, Grand Falls.

BENEFITS: Fuel savings \$43,542 annually

FUEL: 6,880 green tonnes, displacing 8,900 barrels oil
Energy equiv.: 1.18 bbls/green tonnes
(2.36 bbl/BDt)
Value equiv.: \$17.12/green tonne (1978)

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: Savings greatly increased through higher cost of oil displaced and improved production

REPORTS: Internal Report F.P.D.-1-4

PROJECT: Whole Tree Chipping for Hogged Fuel in Newfoundland at Abitibi-Price. Combination of whole tree chipping trials and burn tests. Newfoundland. 1980.

LOCATION: Grand Falls, Newfoundland

PROPONENT: Abitibi-Price
ENFOR (Wilton, Duffett)

OBJECTIVE: Further develop operational techniques for harvesting trees in different stand conditions. Assess amount of disturbance to site due to harvesting, and impact this will have on future crop.

FUNDING: ENFOR: \$88,000
Proponent 30,625

STATUS: Complete

COSTS: Total operating costs \$113,625. Average wood cost \$18.30/green tonne.

SYSTEM: Manual felling, skidders, Morbark 22 Chip-arvester, modified dump trucks.

BENEFITS: Fuel savings up to 32% substituting chipped birch stands compared with Bunker C oil. Harvesting of burned stands resulted in 30% loss due to excessive road building costs.

FUEL: 5,700 tonnes produced from trials. Under burn test 5700 green tonnes displaced 7,000 bbls oil.
Energy equiv.: 1.22 bbls/gr tonnes (2.44 bbl/BDt)
Value equiv.: \$25.85/bbl.

ENVIRONMENTAL: Site disturbance comparable to that resulting from normal harvesting.

CURRENT RESULTS: n/a

REPORTS: ENFOR Report P-115. September, 1980.

PROJECT: Harvesting forest biomass as alternate fuel.

LOCATION: Corner Brook, Newfoundland

PROPONENT: Bowater Newfoundland Ltd.

OBJECTIVE: Test and assess technical and economic feasibility for harvesting wood residuals from previously logged cutovers.

FUNDING: Proponent, ENFOR.

STATUS: Completed.

COSTS: \$42.07/gr tonne based upon production of 8,158 actual tonnes. \$39.00/green tonne projected based on 1983 costs. Straight line depreciation of equipment, five-skidder operation.

SYSTEM: 1) Morbark 22" chipper, 3 skidders, container trucks, existing bark feeder at mill.
2) Integrated full tree operation using Koehring feller-forwarder, Hahn processor, mobile chipper, container trucks to mill.

BENEFITS: Reduced fuel costs at mill. Utilizes residual wood left from previously logged cutovers.

FUEL: 8,185 tonnes green wood chips mixed with bark under burn test produced energy equivalent 1.92 bbls/gr tonne. When burned alone, energy equivalent 1.21 bbls/green tonne. Value equivalents \$57.86/gr tonne and \$36.30 respectively.

ENVIRONMENTAL: Air pollution due to the emission of particulates increased by quantity of wood chips burned. Monitored by Provincial Environment Department.

CURRENT RESULTS: Field trials.

REPORTS: ENFOR Project P-191

PROJECT: Chipping of Slabs, for Fuel, from a Portable Rotary Carriage Sawmill. Newfoundland. 1983.

LOCATION: Millertown, Newfoundland

PROPONENT: Forest Products Development, Dept. Forest Resources and Lands.

OBJECTIVE: Determine economic feasibility. Compare net revenue from woodchip fuel production with previous revenue received from selling slabs as firewood, and determine ratio wood chips per f.b.m. lumber.

FUNDING: Newfoundland Government
DREE

STATUS: Completed

COSTS: Operating cost \$4,095
Wood chip costs \$34.20/green tonne

SYSTEM: Portable rotary carriage sawmill. Morbark Eger Beaver Chipper, truck vans.

BENEFITS: Utilizes small sawmill wastes normally discarded, or slabs sold as firewood. Wood chips sold at loss due to high transportation costs.

FUEL: 120 green tonnes costing \$34.20/green tonnes displacing 155 bbls. Energy equivalent assumed 1.29 bbls/green tonne (2.58 bbl/BDt). Value equivalent:

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: No data

REPORTS: Internal Report F.P.D.-13

PROJECT: Wood Chip Fuel Harvesting and Chipping Development Trial (FPD-WF-1) Central Newfoundland. 1982.

LOCATION: Lewisporte, Newfoundland.

PROPONENT: Department Forest Resources and Lands (Newfoundland Government).

OBJECTIVE: Develop a harvesting system which would have commercial application in Newfoundland. Determine normal production levels in non-commercial forest stand types. Determine realistic production costs for the system.

FUNDING:

STATUS: Completed

COSTS: Contract \$164,700. Produced 3,009 green tonnes @ \$54.70/green tonne.

SYSTEM: Three systems. Best results from System II: Timberjack 30 Feller-Pre Buncher. TJ230 forwarder skidder. Morbark 12 Chip-arvester, tandem and semi-dump trucks.

BENEFITS: Technical feasibility of harvesting non-commercial forest lands was confirmed by the trial.

FUEL: Projected 8,600 green tonnes @ \$47.06/gr tonne displaces 13,416 bbbbls oil.
Energy equiv.: 1.56 bbls/green tonne (3.12 bbls/BDt)
Value equiv.: \$46.80/green tonne

ENVIRONMENTAL: Ground disturbance comparable with normal logging activities.

CURRENT RESULTS:

REPORTS: Internal Report F.P.D.-12

PROJECT: Evaluation of the Chipper Transporter Harvesting System - Project report on the trial run of a chipper harvesting operation in cutover pulpwood locations. Newfoundland. 1983.

LOCATION Glenwood, Newfoundland

PROPONENT Forest Products Development, Department of Forest Resources and Lands

OBJECTIVE: Develop a low cost off-road chip harvesting system to be used in Newfoundland cutovers and to determine production costs. Long-term objective of the Department is to develop a system which would clean up cutovers and supply a competitively priced woodchip fuel.

STATUS: Completed

COSTS: Contract costs \$ 69,280
Wood costs 112.27/green tonne

FUNDING:

SYSTEM: Timberjack 230, 8 ton forwarder, Morbark Eger Beaver Chipper, rear dump chip container, pallet container trucks.

BENEFITS: Low productivity and high costs resulted in a loss.

FUEL: 461 green tonnes wood chips
Energy equiv.: assumed.
Value equiv.:

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: No data

REPORTS: Internal Report F.P.D.-20

PROJECT: Roundwood Harvesting Trials with the Morbell Feller/Buncher in North Central Newfoundland. 1983.

LOCATION: Halls Bay, NF

PROPONENT: Dept. of Forest Resources and Lands

OBJECTIVE: Demonstrate the ability of Morbell to economically harvest small fringe wood during a conventional pulpwood operation.

FUNDING:

STATUS: Trial completed

COSTS: Trial expenditure \$7,157; wood cost \$10.74 a cord; \$5.37 green tonne

SYSTEM: Morbell Feller Buncher, International S-10 grapple skidder Hahn Harvester

BENEFITS: Results of trial indicate this equipment is both productive and economical for the forest conditions encountered.

FUEL: 1,282 green tonnes of cord wood

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS: Internal Report F.P.D.-21

PROJECT: Evaluation of Mint Brook Chipping Trials.
Integrated sawlog harvesting chipping trials.
Newfoundland. 1982.

LOCATION: Mint Brook, Newfoundland.

PROPONENT: Mint Brook Lumber Co.

OBJECTIVE: Determine feasibility of portable sawmill
chipper in production of sawlogs and chipped
waste for fuel.

FUNDING:

STATUS: Completed.

COSTS: Operating costs: \$56,500
Wood chip cost: 46.50/green tonne

SYSTEM: Portable sawmill including debarking/chipping
operations. Locomotive unloader, log deck,
debarker, tractor, Forano chipper, chip van.

BENEFITS: Although operation was at a loss, this trial
indicates that similar operations can be
viable depending upon better wood stands for
sawlog production and stable demand for wood
fuel chips.

FUEL: 878 green tonnes displaced estimated 1,133
bbls oil.
Energy equiv.: Estimated 1.29 bbl/green tonne
(2.58 bbl/BDt)
Value equiv.: Estimated \$41.62/green tonne

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: No data

REPORTS: Internal Report F.P.D.-11

PROJECT: Fuel Wood Distribution. Project report on the harvesting and distribution of roundwood for residential/commercial consumers. Newfoundland. 1983.

LOCATION: Hare Bay, Newfoundland.

PROPONENT: Mr. Lorne Collins.

OBJECTIVE: Demonstrate commercial viability of vertically integrated domestic fuelwood distribution networks in Newfoundland.

FUNDING: Proponent: \$ 7,077
CREDA: 10,000

STATUS: Completed

COSTS: \$17,077. Wood cost \$40.66/green tonne

SYSTEM: 2 - 5 ton trucks, 1 front end loader with forklift, 1 John Deer 1010 tractor, and 1 International 500B tractor.

BENEFITS: Annual fuel savings \$9,595.

FUEL: 210 cords (420 green tonnes) fuel wood displaces estimated 470 bbls oil.
Energy equiv.: 1.12 bbls/gr tonne (2.24 bbls/BDt)
Value equiv.: \$63.08/green tonne

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: Contractor unable to continue due to financial difficulties.

REPORTS: CREDA Project Summary No. 03:04:22:01.

PROJECT: Fuel Peat Harvesting. Project report on the application of fuel peat mining techniques. Central Newfoundland. 1982.

LOCATION: Bishops Falls, NF

PROponent: Noval Industries

OBJECTIVE: Demonstrate the feasibility of mining fuel peat using the Haku and Vacuum methods and burning peat in an industrial setting.

FUNDING:

Canada (CREDA)	\$	653,280
NF (CREDA)		163,320
Memorial Univ./		
Lundrigan/		
Noval		552,000
		\$1,368,000

STATUS: Completed

COSTS:

Capital:	\$1,357,100
Monitoring:	9,500

SYSTEM:

Bog preparation: by MF275, screw leveller and Hondi ditcher

Harvesting: MF285, MF255, MF275

Haku miller, Vacuum miller

BENEFITS: Replace estimated 3,000 bbls oil at Abitibi Price Mill. Expected long-range benefits from burning fuel peat.

FUEL:

500 tonnes fuel peat (50% m.c.) displaces estimated 400 bbls oil.

Energy equiv.: 0.80 bbls/gr tonne (1.60 bbl/BDt)

Value equiv.: \$25.60/green tonne

ENVIRONMENTAL: Not monitored.

CURRENT RESULTS: Contract to supply 1,500 tonnes to Abitibi Price in 1984.

REPORTS: CREDA Project report summary No. 0:04:03.

PROJECT: Sod Peat Demonstration Project. Newfoundland. 1982.

LOCATION: St. Shotts, NF

PROPONENT: Southern Avalon Development Association

OBJECTIVE: Demonstrate economic feasibility of producing sod peat as a fuel source from blanket bogs

FUNDING:

Canada (CREDA):	\$345,000
Newfoundland:	56,400
Canada (CEIC):	100,000

STATUS: Production trial

COSTS: Estimated project costs \$500,200

SYSTEM: Ditching - Kubota KH18L track excavator
Sod extractor - Kubota M7950DT

BENEFITS:

FUEL: 100 tonnes fuel peat "bricks" burn tested in 1983 at approximately 40% M.C. Energy equivalent to wood waste.

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS: Avalon Peat Harvesting Operations Brief
P. Hewitt, 1983. Available from:

Southern Avalon Development Association
St. Shotts, Newfoundland

2.2.4 Studies and Proposals

Studies

NEWFOUNDLAND - STUDIES

WOOD/PEAT ENERGY PROJECT REPORT SUMMARIES

PROponent	LOCATION	FUEL	QUANTITY gr t	COST/ gr t	Bbls OIL DISPLACED	Bbls OIL /gr t	\$ VALUE /gr t	ANNUAL SAVINGS	PAYBACK
ABITID1-PRICE INC	STEPHENVILLE	NOG	40000	0.00	30000	0.75	25.60	0	0.0
DEPT MINES & ENERGY	TREPASSEY	PEAT	8571	0.00	6857	0.80	0.00	0	0.0
DEPT MINES & ENERGY	RODDICTON	WOODCHIPS	850	0.00	1000	1.20	72.00	0	0.0
** TOTAL **			49421		37857				

Proposals

NEWFOUNDLAND - PROPOSALS

WOOD/PEAT ENERGY PROJECT REPORT SUMMARIES

PROponent	LOCATION	FUEL	QUANTITY gr t	COST/ gr t	Bbls OIL DISPLACED	Bbls OIL /gr t	\$ VALUE /gr t	ANNUAL SAVINGS	PAYBACK
DEPT FORESTRY	GRAND FALLS	WOODCHIPS	1500	0.00	1800	1.20	60.00	0	0.0
DEPT MINES & ENERGY	DAIE VERTE	WOODCHIPS	24000	0.00	28600	1.19	47.60	0	0.0
DEPT MINES & ENERGY	CORNER BROOK	WOODCHIPS	13714	0.00	17142	1.25	56.25	0	0.0
FISHERY PRODUCTS INTL	CATALINA	WOODCHIPS	11423	0.00	14286	1.25	62.50	0	0.0
NORTHSTAR CEMENT	CORNER BROOK	WOODCHIPS	18286	0.00	22857	1.25	56.25	0	0.0
TRINITY BRICK LTD	WILTON	WOODCHIPS	4500	0.00	5000	1.25	62.50	0	0.0
** TOTAL **			73423		89685				

PROJECT: Wood waste burning operation - Paper mill.
Newfoundland. 1984.

LOCATION: Stephenville, Newfoundland

PROPONENT: Abitibi-Price Inc.

OBJECTIVE: Upgrade chip handling facilities to burn wood
chips in existing wood waste burning plant

FUNDING:

STATUS: Study

COSTS:

SYSTEM:

BENEFITS:

FUEL: Estimated 10,000 green tonnes whole tree chips
mixed with estimated 30,000 green tonnes mill
bark to displace approximately 30,000 bbls
oil

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS:

PROJECT: Proposed conversion to wood energy - Feasibility study to convert fish plant operation to wood waste fuel. Newfoundland. 1984.

LOCATION: Trepassey, NF

PROPONENT: Dept. of Mines and Energy, NF
Technopeat Limited

OBJECTIVE: Determine technical and economic feasibility of converting to peat fuel

FUNDING:

STATUS: Initiated

COSTS:

SYSTEM: Peat-fired co-generation system to produce steam and generate electricity into local grid

BENEFITS:

FUEL: Peat

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS:

PROJECT: Roddickton Thermal Power Station

LOCATION: Roddickton, Newfoundland

PROPONENT: Dept. Mines and Energy

OBJECTIVE: To produce power for the Thermal Power Stn.
by burning wood chips

FUNDING:

STATUS: Study initiated

COSTS:

SYSTEM:

BENEFITS:

FUEL: Wood chips

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS:

PROJECT: Wooddale Greenhouse conversion to wood waste fuel - Feasibility study

LOCATION: Grand Falls, NF

PROPONENT: Dept. of Forest Resources and Lands

OBJECTIVE: Determine technical and economic feasibility of converting to wood waste fuel

FUNDING:

STATUS: Proposal

COSTS:

SYSTEM:

BENEFITS:

FUEL: Estimated 1,500 green tonnes wood chips required

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: Decision to implement awaiting funding.

REPORTS:

PROJECT: Proposed conversion to wood energy - Feasibility study to convert mining operation to wood energy. Newfoundland. 1984.

LOCATION: Baie Verte, NF

PROPONENT: Dept. Mines and Energy, Newfoundland

OBJECTIVE: Determine technical and economic feasibility to convert to wood energy heating for mine operation

FUNDING:

STATUS: Proposal stage

COSTS:

SYSTEM:

BENEFITS:

FUEL: Wood chips, wood waste displace estimated 28,600 Bbls of Bunker C oil

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: Inadequate forest activities and wood supply to support this size application

REPORTS:

PROJECT: Proposed conversion to wood energy - Feasibility study to convert hospital buildings to wood energy. Newfoundland. 1984.

LOCATION: Corner Brook, NF

PROPONENT: Dept. Mines and Energy, NF

OBJECTIVE: Determine technical and economic feasibility of converting to wood energy heating for hospital

FUNDING:

STATUS: Proposal stage

COSTS:

SYSTEM:

BENEFITS:

FUEL: Wood chips/wood waste to displace estimated 17,142 bbls oil

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS:

PROJECT: Proposed conversion to wood energy - Feasibility study to convert fish plant operation to wood waste fuel. Newfoundland. 1984

LOCATION: Catalina, NF

PROPONENT: Fishery Products International

OBJECTIVE: Determine technical and economic feasibility of converting to wood waste fired heating for fish processing

FUNDING:

STATUS: Proposal stage

COSTS:

SYSTEM:

BENEFITS:

FUEL: Potential for estimated 14,286 bbls fuel oil displacement by approximately 11,429 green tonnes chip and sawmill waste

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS:

PROJECT: Proposed conversion to wood energy - Feasibility study to convert cement manufacturing plant to wood energy. Newfoundland. 1984.

LOCATION: Corner Brook, Newfoundland

PROPONENT: North Star Cement Ltd.
Dept. Mines and Energy, NF

OBJECTIVE: Determine technical and economic feasibility of converting to wood waste heating for cement manufacturing plant

FUNDING:

STATUS: Proposal stage

COSTS:

SYSTEM:

BENEFITS:

FUEL: Wood chips/wood wastes to displace 22,857
bbls oil

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS:

PROJECT: Proposed conversion to wood energy - Feasibility study to convert brick manufacturing plant to wood energy. Newfoundland. 1984.

LOCATION: Milton, Newfoundland

PROPONENT: Trinity Brick Ltd.
Dept. Mines and Energy, NF

OBJECTIVE: Determine technical and economic feasibility of converting to wood waste heating for brick kilns

FUNDING:

STATUS: Proposal stage

COSTS:

SYSTEM:

BENEFITS:

FUEL: Wood chips/sawmill waste to displace estimated 5,000 bbls oil

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS:

2.3 NOVA SCOTIA

Completed Projects

(15 applications reported)

The 15 completed or operational applications reported utilize an estimated 817,429 green tonnes of biomass fuel. It is estimated that 740,250 barrels of oil are displaced indicating an average energy equivalent of 0.90 bbls/green tonne. Assuming an average cost of \$32.00/barrel, this represents approximately \$23,688,000.

Two large pulp and paper applications contribute 93% of the overall demand for biomass fuel.

Nova Scotia Forest Industries	Port Hawksbury	535,000 gr tonnes
Scott Maritimes	New Glasgow	225,000 gr tonnes

Both pulp and paper applications utilize primarily mill bark mixed with hog fuel or wood chips to produce steam and electricity for paper production.

Nova Scotia Forest Industries are harvesting substantial annual volumes (160,000 gr tonnes) of forest residues as wood chips. A high proportion of this material comes from dead wood caused by spruce budworm. Aside from the economic recovery of residues for fuel, this operation has demonstrated positive effects on silviculture and forest management problems.

One large industrial application is reported.

Gordon's Greenhouses	Oxford	35,000 gr tonnes
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The large greenhouse application is a successful example of utilizing abundant supplies of sawmill residues as fuel for a high energy-using industry which otherwise might not be viable.

Incomplete Projects

(5 applications reported)

When completed and operational these projects will utilize an estimated annual volume of 81,367 green tonnes of biomass. This represents approximately 80,765 barrels of oil displaced. Using an estimated cost of \$45.00 per barrel this is equivalent to \$3,634,425.

Studies and Proposals

(3 applications reported)

Active consideration is being given at the feasibility and proposal stage for projects which, if implemented, could utilize an estimated additional annual biomass fuel volume of 81,688 green tonnes. Using an average energy equivalent ratio of 0.90 bbls/green tonne this indicates an approximate oil displacement of 73,519 barrels. This is equivalent to \$2,940,768 at \$40.00 per barrel.

Applications being considered were compiled from a feasibility study prepared for the Department of Mines and Energy

by Neill Gunter (1983). Some 19 potential commercial/industrial and institutional high consumers of oil fuel have been identified in areas where forest and sawmill residues are in abundant supply.

One major prospect which is in the proposal feasibility stage is Canadian Keyes Fibres Inc. and Minas Pulp and Paper. An estimated 80,000 green tonnes of forest and sawmill residues may be utilized to generate steam and electricity.

According to a submission on Nova Scotia's Energy Supply and Demand forecast prepared in January 1984, pulp mill residues will shortly be entirely used by the pulp mills to produce energy. Sawmill residues in the order of 224,000 green tonnes are presently being utilized for energy. An identified surplus of 66,000 green tonnes will go either to the pulp and paper industry or be used by rural industries for energy.

The only large, untapped supply of biomass fuel is logging residues. Some 800,000 green tonnes have been identified and through a variety of federal/provincial programs, it is intended to utilize substantial portions of this biomass for fuel applications.

The Department of Mines and Energy has also commissioned a feasibility study to determine the merits of peat fuel applications in southwestern Nova Scotia. Should positive results be achieved, a demonstration project may be initiated.

Sources of Information

Project Summaries are available from:

Nova Scotia Department of Mines and Energy
P. O. Box 668
Halifax, Nova Scotia
B3J 2T3

2.3.1

NOVA SCOTIA - COMPLETED PROJECTS

WOOD/PEAT ENERGY PROJECT REPORT SUMMARIES

PROPOSITOR	LOCATION	FUEL	QUANTITY gr t	COST/ gr t	Bbls OIL DISPLACED	Bbls OIL /gr t	\$ VALUE /gr t	ANNUAL SAVINGS	PAYBACK
A.R. HENNING LTD	DARTMOUTH	WOOD WASTE	265	0.00	400	1.50	68.25	18200	1.6
BOWATER MERSEY	LIVERPOOL	HOG	8600	0.00	8500	0.90	0.00	0	0.0
BRUCE SCOTT	CANARD	WOODCHIPS	1758	19.62	2286	1.36	57.33	66300	2.2
DAFRON INDUSTRIES	OAKHILL	SANDUST	200	0.00	371	0.00	0.00	15900	3.3
ERFAN LUMBER	U NUSQUODBOIT	SHAVINGS	700	0.00	875	1.25	62.50	0	0.0
GORDON'S GREENHOUSE	DIXFORD	HOG	35000	8.00	30857	0.88	30.86	275000	5.3
LEWIS LUMBER	WEYMOUTH	HOG	4000	0.00	3600	0.90	50.00	0	0.0
LYNDHURST FARMS	CANNING	WOODCHIPS	1000	0.00	1200	1.20	60.00	0	0.0
MABOU GARDENS LTD	INVERNESS	ROUNDWOOD	400	0.00	686	1.70	68.60	15000	2.0
N SCOTIA FOREST IND	PORT HANSMURY	HOG/CHIPS	535000	0.00	500000	0.93	28.04	0	0.0
PIERCE, BILL	SCOTS BAY	WOODCHIPS	295	15.70	423	1.43	63.06	14000	6.0
PORTER & SONS	STELLARTON	SHAVINGS	4000	0.00	5000	1.25	62.50	0	0.0
SCOTT MARITIME LTD	ABERCROMBIE	HOG	225000	12.00	184500	0.82	28.70	1147160	3.6
STOKDUK GRNHSES	TRURO	SHAVINGS	1000	0.00	1250	1.25	62.50	0	0.0
UEFFING, JOE	CANNING	WOODCHIPS	211	15.70	302	1.43	63.06	10000	4.5
** TOTAL **			817429		740250				

PROJECT: Waste Wood Furnace - Report on the application of wood waste burning to reduce heating costs in a wood production plant. Nova Scotia. 1982.

LOCATION: Dartmouth, Nova Scotia

PROPONENT: A. R. Hemming Building Systems Ltd.

OBJECTIVE: Demonstrate use of wood waste to provide space heat for a wood production facility.

FUNDING: Can./NS: \$20,000
Proponent: 8,630

STATUS: Completed

COSTS: Capital \$28,630

SYSTEM: 800,000 BTU/hr., wood burning furnace. Forced air distribution.

BENEFITS: Annual fuel savings \$18,200 (equiv. oil at \$1.70 gal.). Payback 1.6 years.
Eliminates wood waste disposal problem. Increases production of plant on cold days.

FUEL: 400 bbls oil displaced by wood waste

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: n/a

REPORTS: Project Summary No. 011.

PROJECT: Bowater Mersey Paper

LOCATION: Liverpool, NS

PROPONENT: Bowater Mersey Paper

OBJECTIVE: To lower heating cost and reduce dependency on high priced oil

FUNDING: F.I.R.E.: \$ 47,790
Proponent: 363,210

STATUS: 100% complete

COSTS: Capital cost \$411,000

SYSTEM:

BENEFITS: 8,500 bbls oil displaced

FUEL: Wood waste

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS:

PROJECT: Poultry Plant

LOCATION: Canard, NS

PROPONENT: Bruce Scott

OBJECTIVE: To lower heating cost and reduce dependency on high priced oil

FUNDING: Proponent: \$145,000

STATUS: Completed.

COSTS: Capital cost \$145,000
Wood waste fuel av. \$19.62/green tonne

SYSTEM: Argusfyr 3 million BTU/hr wood burning system

BENEFITS: Reduces oil consumption over 25% in first year.
Estimated annual savings \$66,300. Payback 2.2 years.

FUEL: At estimated energy equivalent of 1.36 bbl/green tonne - 2,286 bbls #2 oil displaced by 1,758 green tonnes wood waste (40% chips, 60%. Value equivalent: \$57.33 green tonne

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: No data

REPORTS:

PROJECT: Wood waste furnace - Report on the application of wood waste burning by wood manufacturing. Nova Scotia. 1983.

LOCATION: Oak Hill, Lunenburg, NS

PROPONENT: Dafron Industries

OBJECTIVE: Demonstrate that waste wood containing high percentage of sawdust and shavings can reliably meet space heating requirements of wood manufacturing facility.

FUNDING: Nova Scotia/Can.: \$36,156
Proponent: 22,590

STATUS: Completed.

COSTS: \$58,746.
Wood handling \$1000.

SYSTEM: A 2 million BTU/hr. sawdust burning furnace and boiler by Rettew Automation Inc. Pneumatically conveyed sawdust and shavings to cyclone separator.

BENEFITS: Annual fuel savings \$15,900 from burning wood waste from manufacturing operation. Eliminates waste disposal problem.

FUEL: 371 bbls displaced by waste sawdust.

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: n/a

REPORTS: Project Summary No. 015.

PROJECT: Wood waste burning operation

LOCATION: Upper Musquodoboit, NS

PROPONENT: Erfan Lumber

OBJECTIVE:

FUNDING: N/A

STATUS: Completed, operational

COSTS: N/A

SYSTEM: N/A

BENEFITS:

FUEL: Shavings from wood manufacturing plant
Annual consumption: 700 green tonnes
Projected energy equiv.: 1.25 bbls/gr tonne
Projected value equiv.: \$62.50/green tonne

ENVIRONMENTAL: N/A

CURRENT RESULTS: N/A

REPORTS:

PROJECT: Greenhouse heat from wood waste. Project report on application of alternative wood waste fuel heating system for greenhouse operation, Nova Scotia. 1982.

LOCATION: Oxford, NS.

PROPONENT: Gordon's Greenhouses

OBJECTIVE: Summarizes action taken between 1977-1982 to reduce cost of heating greenhouse operation.

FUNDING: NS: -\$ 350,000 (wood handling facility)
Gordon's - 1,100,000 (wood burning boiler plant)

STATUS: Installation complete.

COSTS: Capital: \$1,450,000
Wood residue: \$8/tonne
Monitoring:
Operating: \$475,000 (estimated)

SYSTEM: Thermal blankets
Wood waste burning boilers (steam) heat system

BENEFITS: Annual fuel savings estimated \$275,000. New markets for silviculture. Contractor uses up poor grade wood waste.

FUEL: 30,857 bbls fuel oil displaced by 35,000 tonnes bark, sawdust, wood chips.
Energy equiv: .88 bbls/gr tonne (1.76 bbls/BDt).
Value equiv.: \$30.86/gr tonne.

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: n/a

REPORTS: Can/NS Project Summary No. 018.

PROJECT: Wood waste burning operations

LOCATION: Weymouth, NS

PROPONENT: Lewis Lumber

OBJECTIVE:

FUNDING: N/A

STATUS: Completed, operational

COSTS: N/A

SYSTEM: N/A

BENEFITS:

FUEL: Hog fuel.
Annual consumption: 4,000 green tonnes
Projected energy equiv.: 0.90 bbls oil/gr tonne
Projected value equiv.: \$50/green tonne

ENVIRONMENTAL: N/A

CURRENT RESULTS: N/A

REPORTS:

PROJECT: Wood waste burning operation

LOCATION: Canning, NS

PROPONENT: Lyndhurst Farms

OBJECTIVE:

FUNDING: N/A

STATUS: Completed, operational

COSTS: N/A

SYSTEM: N/A

BENEFITS:

FUEL: Wood chips
Annual consumption: 1,000 green tonnes
Projected energy equiv.: 1.20 bbls/green tonne
Projected value equiv.: \$60/green tonne

ENVIRONMENTAL: N/A

CURRENT RESULTS: N/A

REPORTS:

PROJECT: Mabou Gardens Ltd.

LOCATION: Inverness County, NS

PROPONENT: Mabou Gardens Ltd.

OBJECTIVE: To lower heating cost and reduce dependency on high priced oil

FUNDING: ENERSAVE: 50%
Proponent: 50%

STATUS: Completed

COSTS:

SYSTEM:

BENEFITS: Annual savings \$15,000.

FUEL: 686 bbls oil displaced by 400 green tonnes cordwood
Fuel equiv.: 1.7 bbl/green tonne (3.4 bbl/BDt)
Value equiv. \$68.60 green tonne

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS:

PROJECT: Wood fuel operation - conversion of large pulp producer to wood waste fuel operation, Nova Scotia. 1982.

LOCATION: Port Hawksbury, Nova Scotia

PROPOSER: Nova Scotia Forest Industries

OBJECTIVE: Reduce fuel costs and dependency upon oil. Utilize excess residuals from pulp operation.

FUNDING:

Proponent:	\$18 million
N.S. (loan):	23 million
F.I.R.E.:	4 million

STATUS: Completed

COSTS: Capital \$45 million

SYSTEM: Swedish wood/bark burning boiler.
Harvesting - Morbark 22 (300 tonnes/day/\$23/t)
Bruks 1001 (50 tonnes/day/\$26/t)

BENEFITS: Profitable conversion from oil to wood waste fuel. Solves forest management problems. Reduces SO₂ emissions.

FUEL: Mixture 40% mill bark, 33% wood chips 15% old bark, 11% mill sludge. Estimated 550,000 bbls oil displaced by 500,000 green tonnes biomass.
Energy equiv.: 1.1 bbls/green tonne
(1.86 bbls/BDt)
Value equiv.: \$35.70 green tonne

ENVIRONMENTAL: Satisfactory pollution levels

CURRENT RESULTS: n/a

REPORTS: Nova Scotia Forest Industries

PROJECT: Barn heating using wood waste. Project report on application of renewable energy for heating farm buildings, Nova Scotia. 1982.

LOCATION: Scot's Bay, Kings County, NS.

PROPONENT: Bill Pierek

OBJECTIVE: Demonstrate that wood chip burning gasifiers and furnaces can reliably provide inexpensive space heat for farm buildings.

FUNDING: NS/Can. \$39,700
Proponent 22,200

STATUS: Completed

COSTS: Capital: \$61,900
Fuel costs: Sawdust \$16.50/tonne
Woodchips 24.00/tonne

SYSTEM: Saturn 400 gasifier - 500,000 BTU/hr
Firefly 100 wood chip preheater, automatic feed hoppers

BENEFITS: Fuel savings: \$14,000 payback 6.0 years

FUEL: 423 bbls oil displaced by 295 green tonnes
Energy equiv.: 1.43 bbl/gr tonne (2.86 bbl/BDt).
Value equiv.: \$63.06/green tonne

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: n/a

REPORTS: Can/NS Project Summary No. 025.

PROJECT: Wood waste burning

LOCATION: Stellarton, NS

PROPONENT: Porter and Sons

OBJECTIVE:

FUNDING: N/A

STATUS: Completed, operational

COSTS: N/A

SYSTEM: N/A

BENEFITS:

FUEL: Shavings.
Annual consumption: 4,000 green tonnes
Projected energy equiv.: 1.25 bbls/gr tonne
Projected value equiv.: \$62.50/green tonne

ENVIRONMENTAL: N/A

CURRENT RESULTS: N/A

REPORTS:

PROJECT: Improvement of Hog Fuel Energy System - application of wood residue burning to supply pulp plant. Nova Scotia. 1980.

LOCATION: Abercrombie, Nova Scotia

PROPONENT: Scott Maritimes Limited

OBJECTIVE: Improve efficiency of existing bark-fired boiler and material handling.

FUNDING: Proponent: \$4,535,200
F.I.R.E.: 364,300

STATUS: Completed

COSTS: Capital \$4,535,200
Purchase of wood residues \$12/green tonne

SYSTEM: Improved hog fuel firing system, two new conveyors, bark press, hog and ancillaries upgrade storage.

BENEFITS: 184,500 bbls. oil displaced (reduction 77% oil needs), eliminates environmental problem related to disposal of wood residues (mill bark).

FUEL: Mill bark mixed with sawmill residue. 225,000 green tonnes displaced 84,500 bbls #6 oil.
Energy equiv.: 0.82 bbls/gr tonne (1.64 bbls/BDt)
Value equiv.: \$28.70/green tonne (\$57.40/BDt)

ENVIRONMENTAL: Meets air quality standard

CURRENT RESULTS: n/a

REPORTS:

PROJECT: Wood waste burning

LOCATION: Truro.

PROPONENT: Stokduik Greenhouses

OBJECTIVE:

FUNDING: N/A

STATUS: Completed, operational

COSTS: N/A

SYSTEM: N/A

BENEFITS:

FUEL: Shavings
Annual consumption: 1,000 green tonnes
Projected energy equiv.: 1.25 bbls/gr tonne
Projected value equiv.: \$62.50/green tonne

ENVIRONMENTAL: N/A

CURRENT RESULTS: N/A

REPORTS:

PROJECT: Barn heating using wood waste. Project report on application of renewable energy for heating farm buildings, Nova Scotia. 1982.

LOCATION: Canning, Kings County, NS

PROPONENT: Joe Ueffing

OBJECTIVE: Demonstrate that wood chip burning gasifiers and furnaces can reliably provide inexpensive space heat for farm buildings.

FUNDING: NS/Can. \$31,900
Proponent 17,800

STATUS: Completed

COSTS: Capital: \$49,700
Fuel costs: Sawdust \$16.50/tonne
Wood chips 24.00/tonne

SYSTEM: Saturn 400 gasifier - 500,000 BTU/hr
"Firefly 100" wood chip preheater, automatic feed hoppers

BENEFITS: Fuel savings: \$10,000 payback 4.5 years

FUEL: 302 bbbbs oil displaced by 211 green tonnes
Energy equiv.: 1.43 bbl/gr tonne (2.86 bbl/BDt)
Value equiv.: \$63.06/green tonne

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: n/a

REPORTS: Can/NS Project Summary No. 026.

2.3.2

NOVA SCOTIA - INCOMPLETE PROJECTS

WOOD/PEAT ENERGY PROJECT REPORT SUMMARIES

PROponent	LOCATION	FUEL	QUANTITY gr t	COST/ gr t	Bbls OIL DISPLACED	Bbls OIL /gr t	\$ VALUE /gr t	ANNUAL SAVINGS	PAYBACK
A.C.CAMPBELL	INVERNESS	WOOD WASTE	0	0.00	13500	0.00	0.00	0	0.0
AVON VALLEY GRNHS	FALMOUTH	WOODCHIPS	13600	28.00	16800	1.24	43.40	212500	4.0
BRITEX LTD	BRIDGETOWN	WOODCHIPS	4300	0.00	5375	1.25	56.25	0	0.0
SCOTT MARITIMES	ABERCROMBIE	HOG	0	0.00	33740	0.90	0.00	0	0.0
STOTT TINDER	SYDNEY	HOG	0	0.00	11350	0.90	0.00	0	0.0
** TOTAL **			17900		80765				

PROJECT: Avon Valley Greenhouses

LOCATION: Falmouth, NS

PROPONENT: Avon Valley Greenhouses Ltd.

OBJECTIVE: To lower heating cost and reduce dependency on high priced oil

FUNDING: F.I.R.E. \$99,000
Proponent 874,000

STATUS: Initiated

COSTS: Capital cost \$973,000
Estimated wood cost \$28/green tonne

SYSTEM: Bruks solid fuel heating system, 30 million BTU/hr fuel.

BENEFITS: Reduction in oil consumption. Estimated annual savings \$212,500. Payback 4 years.

FUEL: 16,800 bbls oil displaced. Estimated
13,600 green tonnes. Sawmill residue.
Energy equiv.: 1.24 bbls/gr tonne (2.48 bbl/
BDt)
Value equiv. \$43.40/green tonne

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS:

PROJECT: Scott Maritimes Pulp Mill. Nova Scotia.
1983.

LOCATION: East Point

PROPONENT: Scott Maritimes

OBJECTIVE: To lower heating cost and reduce dependency
on high priced oil

FUNDING: F.I.R.E.: \$ 735,300
Proponent: 7,497,700

STATUS: 45% complete

COSTS: \$8,233,300

SYSTEM:

BENEFITS: 33,740 bbls oil displaced

FUEL: Wood waste

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: No data

REPORTS:

PROJECT: A.C. Campbell Contractors

LOCATION: Inverness County, NS

PROPONENT: A.C. Campbell Contractors

OBJECTIVE: To lower heating cost and reduce dependency
on high priced oil

FUNDING: F.I.R.E.: \$ 74,200
Proponent: 316,800

STATUS: Initiated

COSTS: Capital cost \$391,000

SYSTEM:

BENEFITS: 13,500 bbls oil displaced

FUEL: Wood waste

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS:

PROJECT: Stott Timber Corp.

LOCATION: Sydney, NS

PROPONENT: Stott Timber Corp.

OBJECTIVE: To lower heating cost and reduce dependency
on high priced oil

FUNDING: F.I.R.E.: \$ 169,600
Proponent: 1,413,400

STATUS: 100% completed

COSTS: Capital cost \$1,583,000

SYSTEM:

BENEFITS: 11,350 bbls oil displaced

FUEL: Wood waste

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: Company reported bankrupt, 1984

REPORTS:

PROJECT: Textile Production Plant

LOCATION: Bridgetown, Nova Scotia

PROPONENT: Britex Ltd.

OBJECTIVE: To lower heating cost and reduce dependency on high priced oil

FUNDING: NS (Pilot project) \$150,000
Proponent: 181,000

STATUS: Implementation

COSTS: \$331,000

SYSTEM: 8,000,000 BTU wood waste burning boiler

BENEFITS: Reduce energy costs, improve silviculture by utilizing forest residues.

FUEL: 4,300 green tonnes wood chips (80% hardwood forest residues by local supplier)

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS:

2.3.3 Studies and Proposals

Studies

NOVA SCOTIA - STUDIES

WOOD/PEAT ENERGY PROJECT REPORT SUMMARIES

PROPONENT	LOCATION	FUEL	QUANTITY gr t	COST/ gr t	Bbls OIL DISPLACED	Bbls OIL /gr t	\$ VALUE /gr t	ANNUAL SAVINGS	PAYBACK
DEPT MINES & ENERGY	SUNSET HOME	WOODCHIPS	442	35.00	624	1.35	62.94	0	0.0
DEPT MINES & ENERGY	ABCO	WOODCHIPS	1226	35.00	1659	1.35	67.45	0	0.0
** TOTAL **			1688		2283				

Proposals

NOVA SCOTIA - PROPOSALS

WOOD/PEAT ENERGY PROJECT REPORT SUMMARIES

PROPONENT	LOCATION	FUEL	QUANTITY gr t	COST/ gr t	Bbls OIL DISPLACED	Bbls OIL /gr t	\$ VALUE /gr t	ANNUAL SAVINGS	PAYBACK
NINAS BASIN PULP	NANTSPOUT	HOG	80000	0.00	70000	0.89	0.00	0	0.0
** TOTAL **			80000		70000				

PROJECT: Forest Residue Wood Chip Substitution Study.
Nova Scotia. 1983.

LOCATION: Sunset Home New Plant

PROPONENT: Dept. Mines and Energy

OBJECTIVE: Identify potential suppliers and consumers of wood chips for fuel. Identify three prime sites to demonstrate the technology associated with wood chips as a fuel source.

FUNDING:

STATUS: Study completed

COSTS:

SYSTEM:

BENEFITS: 462 green tonnes wood chips displace 624 bbls oil. Energy equiv.: 1.35 bbls/gr tonne (2.70 bbls/BDt). Value equiv.: \$62.94/gr tonne.

FUEL: Wood chips

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS: Neill and Gunter 1983 *

*See bibliography

PROJECT: Forest Residue Wood Chip Substitution Study.
Nova Scotia. 1983.

LOCATION: ABCO Plastics, Lunenburg

PROPONENT: Dept. of Mines and Energy

OBJECTIVE: Identify potential suppliers and consumers of wood chips for fuel. Identify three prime sites to demonstrate the technology associated with wood chips as a fuel source.

FUNDING:

STATUS: Study completed

COSTS:

SYSTEM:

BENEFITS: 1,226 green tonnes wood chips displaces 1,659 bbls oil. Energy equiv.: 1.35 bbls/gr tonne (2.70 bbls/BDt). Value equiv.: \$67.45 green tonne.

FUEL: Wood chips

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS: Neill and Gunter 1983*

*See bibliography

PROJECT: Integrated wood residue energy plant

LOCATION: Hansport, NS

PROPONENT: Canadian Keyes Fibres Inc.
Minas Pulp and Paper

OBJECTIVE: Determine feasibility of expanding wood waste fired energy plant to produce low cost steam and electricity

FUNDING:

STATUS: Proposal stage

COSTS:

SYSTEM: Existing wood waste plant to be expanded, upgraded to produce steam and electricity.

BENEFITS: Reduce annual cost of fuel. Silviculture improvement through utilization of forest residues. Alternate power supply.

FUEL: Proposed 80,000 green tonnes wood chips and ground wood to displace estimated 70,000 bbls oil. Energy equivalent: .89 bbls/gr tonnes (1.78 bbls/BDt)

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS:

2.4 PRINCE EDWARD ISLAND

Completed Projects

(9 applications reported)

The estimated annual biomass fuel required for nine completed projects is 38,400 green tonnes. This represents an estimated displacement of 28,659 barrels of oil giving an average energy equivalent of 0.75 bbls/green tonne. Assuming a cost of \$45.00 per barrel, this is approximately \$1,289,655.

By far the greatest impact is from the Prince Edward Island Energy Corporation Solid Waste-burning Plant in Parkdale. This application alone consumes an estimated 26,000 green tonnes of combustible wastes, displacing approximately 13,500 barrels of oil. Wood chips and other biomass are mixed with the solid wastes to provide a fuel supply.

Another significant application is the Kings County Memorial Hospital, which has been converted from oil to wood burning. This application consumes 2,000 green tonnes of wood chips annually, displacing 2,300 barrels of oil.

Incomplete Projects

(4 applications reported)

Four small industrial and institutional applications when completed will displace an estimated 1,000 barrels of oil per year.

Studies and Proposals

(2 applications reported)

Detailed feasibility is being studied by the P.E.I. Energy Corporation to convert the old P.E.I. hospital to wood chip fuel. Also in the proposal stage is a district heating system for Charlottetown using wood chips for fuel.

Sources of Information

Information Sheets are available from:

Prince Edward Island Energy Corporation
P. O. Box 2000
Charlottetown, Prince Edward Island
C1A 7N8

2.4.1

PRINCE EDWARD ISLAND - COMPLETED PROJECTS

WOOD/PEAT ENERGY PROJECT REPORT SUMMARIES

PROPOSITOR	LOCATION	FUEL	QUANTITY gr t	COST/ gr t	Bbls OIL DISPLACED	Bbls OIL /gr t	\$ VALUE /gr t	ANNUAL SAVINGS	PAYBACK
ABRAM'S VILLAGE SCH	ABRAM'S VILLAGE	WOODCHIPS	1200	0.00	1440	1.20	60.00	0	0.0
CITY CHARLOTTETOWN	CHARLOTTETOWN	SOL WASTE	26000	0.00	13490	0.52	23.35	0	0.0
KINGS CO MEM HOSP	MONTAGUE	WOODCHIPS	2000	0.00	2286	1.14	40.00	0	0.0
M.F.SCHURMAN	CHARLOTTETOWN	WOODCHIPS	6200	0.00	7440	1.20	60.00	0	0.0
MONTAGUE JR HIGH SCH	MONTAGUE	WOODCHIPS	500	0.00	695	1.29	64.50	0	0.0
ROYALTY GRNS GRNHSE	WEST ROYALTY	ROUNDWOOD	0	0.00	0	0.00	0.00	0	0.0
SUMMERSIDE MANOR	SUMMERSIDE	WOODCHIPS	800	0.00	960	1.20	60.00	0	0.0
SUMMERSIDE SASH & DR	SUMMERSIDE	SHAVINGS	1200	0.00	1500	1.20	62.50	0	0.0
VAN KAMPEN GRNHSES	CHARLOTTETOWN	STRAM	500	0.00	848	1.70	0.00	0	0.0
** TOTAL **			38400		28659				

PROJECT: Wood waste burning

LOCATION: Abraham's Village, PEI

PROPONENT: Abraham's Village School

OBJECTIVE:

FUNDING: N/A

STATUS: Completed, operational

COSTS: N/A

SYSTEM: N/A

BENEFITS:

FUEL: Wood chips
Annual consumption: 1,200 green tonnes
Projected energy equiv.: 1.20 bbls/gr tonne
Projected value equiv.: \$60.00/green tonne

ENVIRONMENTAL: N/A

CURRENT RESULTS: N/A

REPORTS:

PROJECT: Municipal solid waste burning operation

LOCATION: Charlottetown, PEI

PROPONENT: City of Charlottetown

OBJECTIVE: To lower heating cost and reduce dependency on high priced oil

FUNDING: F.I.R.E.: \$1,772,500
Proponent: 8,027,500

STATUS: 100% completed

COSTS: Capital cost \$9,800,000

SYSTEM: Solid waste heating plant, designed, constructed and operated by Tricil Ltd. Produces steam heat sold to Queen Elizabeth and Riverside Hospitals

BENEFITS: 13,490 bbls oil displaced

FUEL: Municipal solid wastes supplemented by wood chips
Annual consumption: 26,000 green tonnes
Projected energy equiv.: 0.52 bbl/gr tonne
Projected value equiv.: \$27.60/green tonne

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: N/A

REPORTS:

PROJECT: King's County Memorial Hospital heating system conversion.

LOCATION: Montague, King's County, PEI

PROPONENT: Prince Edward Island Energy Corp.

OBJECTIVE: To replace one of the two oil-fired boilers used by the hospital

FUNDING: DREE 80%; PEI Government 20%

STATUS: Operational. Installed in 1981; operating successfully.

COSTS: Capital cost: \$388,000; testing and evaluation: \$50,000. Chip costs \$30/green tonne.

SYSTEM: A Swedish designed wood chip fired furnace with a 1000 C combustion chamber and a 90 hp capacity Canadian-manufactured boiler operate at greater than 70% efficiency on chips containing up to 60% moisture content. Augers feed the chips into the furnace from a 50-ton horizontal silo.

BENEFITS: The system displaces 80,000 gallons of No.2 fuel oil annually. Provides market for locally produced wood chips. Annual fuel savings \$40,000. Payback- 10 years.

FUEL: 2,000 green tonnes wood chips displaces 2,286 bbls. No. 2 oil. Energy equiv. 1:14 bbls/gr tonne (2.28 bbls/BDt).
Value equiv.: \$49.87 green tonne.

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: Operating successfully

REPORTS: Information sheet

PROJECT: Wood waste burning operation

LOCATION: Charlottetown, PEI

PROPONENT: M.F. Schurman

OBJECTIVE:

FUNDING: N/A

STATUS: Completed, operational

COSTS: N/A

SYSTEM: N/A

BENEFITS:

FUEL: Wood chips
Annual consumption: 6,200 green tonnes
Projected energy equiv.: 1.20 bbls/gr tonne
Projected value equiv.: \$60.00/green tonne

ENVIRONMENTAL: N/A

CURRENT RESULTS: N/A

REPORTS:

PROJECT: Montague Junior High School heating system conversion.

LOCATION: Montague, Kings County, Prince Edward Island

PROPONENT: Prince Edward Island Energy Corporation

OBJECTIVE:

- (1) To provide on-island wood burning units.
- (2) To conduct performance evaluations on the units.
- (3) To demonstrate these systems to the private and public sector as a viable alternative to oil-fired systems.
- (4) To increase the demand for wood chips as a fuel in conjunction with the implementation of the Forestry Development Program.

FUNDING:

STATUS: Operational. Became operational in December, 1983. Operating successfully.

COSTS: System cost \$138,700. Total project cost \$165,000.

SYSTEM: A wood chip fired furnace and a 20 hp capacity boiler.

BENEFITS: Displaces 645 barrels of fuel oil annually.

FUEL: Wood chips; 500 green tonnes consumed annually.

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: Operating successfully.

REPORTS: Information sheet

PROJECT: Royalty Gardens Greenhouse

LOCATION: West Royalty (near Charlottetown) PEI.

PROPONENT:

OBJECTIVE: To reduce dependence on oil.

FUNDING:

STATUS: Operational

COSTS: \$24,000

SYSTEM: A 430,000 BTU roundwood-fired furnace and boiler with manual stoking.

BENEFITS:

FUEL: Roundwood

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: System successfully heats a 4,500 square foot greenhouse and 6,000 square foot apartment space.

REPORTS:

PROJECT: Wood waste burning operation

LOCATION: Summerside, PEI

PROPONENT: Summerside Manor

OBJECTIVE:

FUNDING: N/A

STATUS: Completed, operational

COSTS: N/A

SYSTEM: N/A

BENEFITS:

FUEL: Wood chips
Annual consumption: 800 green tonnes
Projected energy equiv.: 1.20 bbls/gr tonne
Projected value equiv.: \$60.00/green tonne

ENVIRONMENTAL: N/A

CURRENT RESULTS: N/A

REPORTS:

PROJECT: Wood waste burning operation

LOCATION: Summerside, PEI

PROPONENT: Summerside Sash and Door

OBJECTIVE:

FUNDING: N/A

STATUS: Completed, operational

COSTS: N/A

SYSTEM: N/A

BENEFITS:

FUEL: Shavings
Annual consumption: 1,200 green tonnes
Projected energy equiv.: 1.20 bbls/green tonne
Projected value equiv.: \$62.50/green tonne

ENVIRONMENTAL: N/A

CURRENT RESULTS: N/A

REPORTS:

PROJECT: Straw burning at van Kampens Greenhouses. A Passat straw burning system was installed over the winter of 1982/83 and is being used as the principal heating system for a greenhouse complex of 68,000 sq. ft. The boiler has a rated output of 1,168 kW producing low pressure steam used for heating.

LOCATION: Charlottetown, PEI.

PROPONENT: PEI Energy Corporation under the Canada/PEI Agreement in Renewable Energy Development.

OBJECTIVE:

- (1) To reduce the overall dependency on oil
- (2) To produce annual savings on the heating bill.
- (3) To demonstrate the system to the private and public sectors as a viable alternative to an oil-fired system.

FUNDING:

STATUS: The system was installed over the winter of 1982/83 and is presently being evaluated for efficiency and cost benefits.

COSTS: Capital cost \$205,000. The PEI Energy Corp. provided a grant of \$68,330 toward the capital cost.

SYSTEM:

BENEFITS: In April 1983 the fuel consumption of the system was found to be between 4-5 round bales of straw per day. Each bale contains approximately 450 kg of straw. The estimated oil saving is 848 barrels annually.

FUEL: Straw

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS:

2.4.2

PRINCE EDWARD ISLAND - INCOMPLETE PROJECTS

WOOD/PEAT ENERGY PROJECT REPORT SUMMARIES

PROPOONENT	LOCATION	FUEL	QUANTITY gr t	COST/ gr t	Bbls OIL DISPLACED	Bbls OIL /gr t	\$ VALUE /gr t	ANNUAL SAVINGS	PAYBACK
GLEN WILLIAMS	MONTAGUE		0	0.00	0	0.00	0.00	0	0.0
P. CURLEY	ALLISTON	ROUNDWOOD	0	0.00	232	0.00	0.00	0	0.0
PEI ENERGY CORP	O'LEARY	WD PELLETS	0	0.00	0	0.00	0.00	0	0.0
PEI ENERGY CORP	WEST ROYALTY	WOODCHIPS	800	0.00	960	1.20	0.00	0	0.0
** TOTAL **			800		1192				

PROJECT: Glen Williams Greenhouse

LOCATION: Montague, PEI

PROponent: Glen Williams Greenhouse

OBJECTIVE: To lower heating cost and reduce dependency
on high priced oil

FUNDING: F.I.R.E.: \$ 4,140
Proponent: 60,860

STATUS: Initiated

COSTS: Capital cost \$65,000

SYSTEM: N/A

BENEFITS:

FUEL: N/A

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: N/A

REPORTS:

PROJECT: P. Curley Tobacco Farm

LOCATION: Alliston, PEI

PROPONENT: P. Curley Tobacco Farm

OBJECTIVE: Reduce heating cost and dependency on high priced oil

FUNDING: F.I.R.E.: \$11,000
Proponent: 44,000

STATUS: 73% complete

COSTS: Capital cost \$55,000

SYSTEM: A 1.5×10^6 BTU roundwood-fired furnace and a 12,000 gallon non-pressurized hot water storage tank

BENEFITS: 232 bbls oil displaced

FUEL: Roundwood

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: N/A

REPORTS:

PROJECT: West Prince Regional Service Center. A wood pellet fired system.

LOCATION: O'Leary, Prince Edward Island

PROPONENT: Prince Edward Island Energy Corporation

OBJECTIVE: To replace an oil fired heating system

FUNDING:

STATUS: Inactive. Began in 1980 and ceased operation in 1982 because of unavailability of pellets on PEI. The original pellet supply (from Maine) was discontinued.

COSTS:

SYSTEM: A 500,000 BTU system consisting of a wood pellet fired furnace and a 15 hp low pressure boiler.

BENEFITS:

FUEL: Wood pellets

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS:

REPORTS:

PROJECT: Sleepy Hollow Correction Centre. An original biomass gasifier system was found inefficient and removed in 1980. A wood chip fired system is to be installed.

LOCATION: West Royalty (near Charlottetown) Prince Edward Island

PROPONENT: Prince Edward Island Energy Corporation

OBJECTIVE: To lower heating cost and reduce dependency on high priced oil

FUNDING: Federal Government 80%; Government of PEI 20%

STATUS: Installation stage. The wood chip system is expected to be operational by September, 1984.

COSTS: System cost \$86,000. Total project cost \$130,000.

SYSTEM: A wood chip fired furnace and 40 hp capacity boiler.

BENEFITS:

FUEL: Wood chips
Annual consumption: 800 green tonnes
Projected energy equiv.: 1.20 bbls/green tonne
Projected value equiv.: -

ENVIRONMENTAL: No environmental monitoring.

CURRENT RESULTS: N/A

REPORTS:

2.4.3 Studies and Proposals

Studies

PRINCE EDWARD ISLAND - STUDIES

WOOD/PEAT ENERGY PROJECT REPORT SUMMARIES

PROponent	LOCATION	FUEL	QUANTITY gr t	COST/ gr t	Bbls OIL DISPLACED	Bbls OIL /gr t	\$ VALUE /gr t	ANNUAL SAVINGS	PAYBACK
PEI HOSPITAL	CHARLOTTETOWN	WOODCHIPS	8000	0.00	0	0.00	0.00	0	0.0
** TOTAL **									

Proposals

Nil

PROJECT: Old PEI Hospital conversion to wood chip firing system.

LOCATION: Charlottetown

PROPONENT:

OBJECTIVE: To lower heating cost and reduce dependency on high priced oil

FUNDING:

STATUS: Detailed feasibility stage

COSTS: Projected costs \$1 - \$1.5 million

SYSTEM: A wood chip fired system with a projected capacity of 10×10^6 BTU.

BENEFITS: It is proposed that this project could heat the Provincial Government Buildings on Rochford Street (Charlottetown), as well as the PEI Hospital.

FUEL: Wood chips; projected requirement of 8,000 green tonnes annually.

ENVIRONMENTAL: No environmental monitoring

CURRENT RESULTS: Decision to be made in May 1984 whether or not to proceed.

REPORTS:

3. ENVIRONMENTAL IMPACTS FROM BIOMASS HARVESTING

The environmental consequences of large-scale harvesting and combustion of wood/peat biomass in Atlantic Canada will be considered in this section of the report.

3.1 Wood

3.1.1 Harvesting

Clearly, intensive harvesting of the forest resource for energy or for any other purpose could have a number of negative effects on the environment. The more important of these are site nutrient impoverishment, erosion and leaching, changes in site hydrology, effects on aesthetics and recreation, and loss of wildlife habitat (Bell et al., 1974; Kimmins, 1973, 1980). Each of these potential effects will be discussed briefly.

Nutrient Impoverishment

The conventional bole-only method of harvesting the forest resource does not usually cause major loss of site nutrients. However, this method does not produce the greater amount of biomass which can be produced by other harvesting schemes. For example, whole-tree (above-ground), and perhaps even complete-tree (above and below ground) harvesting will maximize biomass production from a forest site. If such intensive

harvesting methods are widely used throughout Atlantic Canada however, it is quite likely that increased nutrient impoverishment will accompany the increased biomass yield.

This increase in the rate and quantity of nutrient loss where intensive harvesting is practiced is due to the removal from the site of such nutrient rich material as foliage, twigs, and small branches. Future deterioration of many such sites is likely, particularly in view of the fact that most forest stands in Atlantic Canada are already nutrient-poor (Weetman, et al. 1974).

Although some site deterioration is likely, the environmental effects of intensive harvesting are not all that clear. There is a general paucity of nutrient-related data for Atlantic Canada. Also, because of great variation between sites, species, stand age, etc., it is difficult to generalize on a regional basis (Freedman, 1981). Nevertheless, it does appear that intensive harvesting on a short rotation basis will deplete nutrients to the point where restoration by fertilization will be required. Over a longer term (100-year period, for example) and possibly medium-term rotations, however, intensive harvesting results in more moderate depletion of site nutrients; depletions that may not require fertilization treatment (Freedman, 1981).

Leaching

Intensive harvesting of some forest stands may lead to an increase in the rate at which soluble nutrients leach from the soil. These nutrients are lost to the system via groundwater or stream flows. This not only results in a lowering of soil fertility, but may also alter freshwater quality and wildlife habitat downstream (Corbett et al., 1978; Vitousek et al., 1979). In general, however, nutrient losses are short-term and usually represent a small percentage of site nutrient capital (Likens et al., 1978).

Procedures are known for reducing nutrient loss from intensely harvested watersheds. Marks and Bormann (1972) suggest that encouraging the rapid establishment of a regenerating plant community (such early successional species as Alnus spp., Prunus pensylvanica and Viburnum cassinoides) will be beneficial.

Erosion

Harvesting, particularly intensive harvesting, of forest stands may lead to accelerated rates of soil erosion at the site. Ecological effects resulting from this include not only losses of soil, but also siltation of aquatic habitats and destruction of wildlife habitats (Corbett et al., 1978).

It is generally agreed, however, that many (perhaps most) erosion and sedimentation problems resulting from timber harvesting are not caused by timber removal alone, but by the manner in which the soil is disturbed during the operation. If proper procedures are followed, large erosional losses need not occur. Proper procedures include (i) careful planning of forest roads, (ii) avoidance of stream disturbances, (iii) leaving buffer strips of uncut forest along watercourses, (iv) careful installation of culverts, and (v) allowing rapid revegetation of site (Case and Rowe, 1978; Curran and Etter, 1976; Groenwols, 1977).

Hydrology

Forests exert a powerful influence on the hydrologic régime of watersheds. Therefore, it is to be expected that the harvesting of forested watersheds would lead to an increase in stream water yield since transpiration surfaces have been much reduced. This increase in streamflow is usually greatest in the year after the watershed has been cut; in subsequent years there is generally a rapid decline until levels approaching pre-harvest conditions are reached (Anderson et al., 1976; Huff et al., 1978). Because transpiration is normally greatest during the growing season, the increase in stream flow peaks at that time.

Studies show that while increases in streamwater yields of up to 40% have been observed in the first year after cutting, normal "pre-cut" levels are frequently attained after 3-5 years primarily because of revegetation. The magnitude of the change in streamwater yield and the length of time required for the yield to return to pre-cut levels are both related to the intensity of the harvest (Freedman, 1981). Few disruptions to the hydrologic régime are likely, particularly on larger watersheds, if the harvest management strategy is one of sustained yield over the long-term.

Aesthetics and Recreation

It is generally accepted that recreation is a legitimate, and in many areas an economically significant, use of forest lands. Such recreational opportunities as hunting, fishing, hiking, camping, etc., are increasingly being accommodated in multiple-use management plans, together with forestry. Intensive harvesting of the forests of Atlantic Canada can detract from these recreational activities, particularly in the early years after cutting when the visual impact is greatest. However, this impact can be reduced by using smaller, irregular shaped cuts, leaving buffer strips, using less intensive harvesting techniques, and by utilization of the logging residues normally left following conventional pulpwood and sawlog harvesting.

Wildlife

Forestry operations may result in loss of habitat for some

fish and wildlife species, while at the same time creating new opportunities for other species. There has been much discussion of this matter in the literature (Benson and Dodds, 1977); Bergerud and Manuel, 1968; Corbett et al., 1978; Dodds, 1960; Hall and Epps, 1969; Lyon and Jensen, 1980; Patric, 1976; Reynolds, 1969). Generally, it is accepted that forest lands can be managed to produce sustained yields of biomass and also permit the retention of wildlife values. The objectives must be to integrate the management of forests and forest fish and wildlife.

3.1.2 Combustion

This discussion will deal with both the residential and commercial/industrial use of wood fuel. Considerably more data are available on the former compared to the latter.

Residential Combustion

Within the last ten years, investigators have collected considerable evidence to indicate that emissions resulting from the widespread use of residential wood-fired appliances could lead to serious deterioration of air quality. Cooper (1980) states that this problem currently exists over a large part of the United States (particularly in urban and suburban areas) and that, if allowed to continue, will likely have a significant impact on public health and industrial growth, and on government regulatory policy.

Health concerns for emissions from residential wood-burning appliances relate to the particulate matter and the chemicals formed due to incomplete combustion. The relatively cool and oxygen-deficient combustion conditions which exist in the "air-tight" wood stove permit large quantities of these pollutants to escape into the airshed. The emissions are almost entirely in the inhalable size range and may contain toxic pollutants, carcinogens, co-carcinogens, mucus coagulating agents, and other respiratory irritants (Cooper, 1980).

Cooper (1980) concludes that emissions from residential wood combustion sources must be considered a major threat to public health because of their highly respirable nature, the hazardous chemicals they contain, their presence in residential areas, and because the emissions are increasing.

Cooper's work drew mainly on the experience in the United States. Are there similar concerns for Canada, particularly Atlantic Canada?

Section 1.1 of this report confirms that the use of wood burning appliances in residences in Atlantic Canada is increasing. Thus it would appear that the potential for developing high levels of particulate matter and other

hazardous pollutants contained in residential wood combustion emission does exist.

This potential may only be realized occasionally, however, when the region's climate is considered. The proximity of the Atlantic Ocean generates sufficient low-level instability that limited vertical mixing takes place readily. In addition, the light wind conditions necessary for the accumulation of pollutants to hazardous levels rarely persist for more than 24 hours before being replaced by stronger winds. Exceptions to this general wind pattern are areas close to the Appalachians and in the area around Stephenville (Munn et al., 1978). However, despite these highly dispersive meteorological conditions, pollutions from residential wood burning in Atlantic Canada may be a greater problem than anticipated because of the popularity of wood as a fuel in this region. A study on the impact of residential wood burning on urban air quality in Canada (Intera Environmental Consultants Ltd., 1983) identified a number of urban areas in Atlantic Canada which could develop serious air pollution problems from residential wood combustion emissions. Considered to have a potential problem are:

- | | |
|--------------|-----------------|
| Newfoundland | - Corner Brook |
| | - Stephenville |
| | - Goose Bay |
| | - Labrador City |

Nova Scotia	- Truro
	- Bridgewater
New Brunswick	- Bathurst
	- Chatham
	- Oromocto
	- Lac Megantic
Pr. Edward Island	- Charlottetown
	- Summerside

It should be pointed out that this study by Intera Environmental Consultants Ltd. makes no actual attempt to determine whether or not wood burning emissions are a problem, nor does it attempt to quantify the potential impact of pollution due to wood burning. The study's mandate was only to compare local wood-use statistics obtained from Statistics Canada with local climatological statistics from the Atmospheric Environment Service. It is, nevertheless, an interesting study. Highly ranked centres (high potential problem) should be considered for further investigation related to wood burning emissions.

Commercial/Industrial Combustion

There is a paucity of literature on the impact of emissions from wood-fired commercial/industrial developments. Information for this brief section of the report was obtained

primarily from interviews with individuals in the provincial energy offices and provincial Department of Environment offices in Atlantic Canada.

Incomplete oxidation during combustion is the major reason for hazardous emissions from residential wood burning appliances. This problem generally does not exist in the commercial/industrial application. Here the system efficiently burns some form of wood fuel at consistently high temperatures with a high degree of combustion, and produces emissions that contain little, if any, toxic or carcinogenic substances. Aesthetic considerations appear to be the major concern related to commercial/industrial use of wood; soot, if not kept at low levels in the emissions, can foul the surrounding area.

All individual interviews were in agreement that a commercial/industrial system designed to burn wood (whether as chips, waste, roundwood, etc.) would produce emissions that were basically clean. There was also agreement that conversions of older systems to wood biomass are usually not as efficient and emissions from such conversions may contain some undesirable and toxic pollutants.

3.2 Peat

3.2.1 Harvesting

Peatlands are useful and functional components of the natural environment. The potential large-scale development and harvesting of peatlands for fuel (as well as for horticultural) purposes in Atlantic Canada has given rise to the concern that the function of these wetlands, and their relationship to the surrounding environment, may be affected. The general environmental concerns described here are essentially those concerns expressed by Gillis and Gemmel (1979) for peatland development in New Brunswick.

Water Quality

Peatland mining normally requires the installation of ditches to drain the areas to be harvested. Depending on the type of bog, the water discharged from these ditches may be low in pH and mineral nutrients and have high levels of heavy metals, suspended solids, and humic acids. The majority of watercourses in Atlantic Canada have limited buffering capacity, and increased volumes of water entering them from peatland development could result in a lower pH and overall degradation of the quality of the receiving waters. This, in turn, could negatively affect salmon and trout populations, as well as overall stream ecology.

Where peatland development results in drainage ditches entering directly into the ocean, the effects of bog drainage may well be mitigated by the buffering capacity of sea water.

Hydrologic Effects

The hydrologic role of peat bogs is not completely understood. It is generally believed, however, that bogs regulate discharge into connecting watercourses during peak flow, and augment flows to those same watercourses during periods of low flows. If peat bogs do, in fact, perform this important regulating function, development and drainage of particular peat bogs could affect the flows in watercourses with which they are associated.

Dust

When the development has reached the mining stage, fugitive dust from stock piles and milled peat may create an air quality problem. The significance of this dust problem will depend on: (i) quantities produced (ii) proximity of sensitive biological communities, (iii) proximity of human settlements, and (iv) effectiveness of mitigation measures to deal with the dust problem.

Habitat Significance

Throughout Atlantic Canada, peatlands supply important habitat

to terrestrial wildlife and waterfowl. The degree of usage is generally not known and therefore it is not possible to quantify the importance of peatlands as wildlife habitat. Clearly, some bogs will be more important than others in this respect. However, careful consideration should be given to this matter when bog development is being proposed.

Reclamation

After a bog has served its function as a fuel peat source (or horticultural peat source) it will likely have to be rehabilitated. This rehabilitation (or reclamation) often has residual effects. For example, reclamation will probably call for the large-scale application of fertilizers. The effect that this will have on the water quality of receiving waterbodies will have to be considered when assessing peatland development.

3.2.2 Combustion

There are very few data on the environmental consequences of burning peat directly, or on the use of converted and upgraded peat (eg., semi-coke and gas). Most peats are low in ash and sulphur, and high in volatiles--qualities that make peat clean to burn or to convert to synthetic fuel.

3.3 Monitoring Programs

The Provincial Departments of Environment in each of the four Atlantic Provinces are not monitoring the environmental impact of large-scale harvesting and combustion of wood/peat biomass within their jurisdictions. They do, however, act on citizen complaints; and in some cases the "compliance" requirements of industry fairly well minimizes the problem.

All departments are keeping abreast of developments within the province and the region, and elsewhere. And all are current with respect to the impact literature on biomass harvesting and combustion. It is the feeling generally that if the need arises, existing legislation can be used to require impact assessment of, and to gain overall regulatory control over, large-scale biomass developments.

The Federal Government (Environmental Protection Service) has some authority in the area of emissions control by virtue of the Federal Clean Air Act. However, EPS usually acts jointly with the particular province concerned in dealing with the problem of emissions. In Newfoundland, for example, EPS and the Provincial Department of Environment act in a mutual trust arrangement, usually through the province's Clean Air Act since that Act is stronger than its federal counterpart.

A mutual trust arrangement is also in place in Prince Edward Island. In the other Atlantic Provinces, regulatory action is usually through an official Federal/Provincial accord.

The essence of the interviews with Department of Environment personnel in each province is presented below.

3.3.1 Newfoundland

Harvesting

The Newfoundland Department of Environment is phasing in a general environmental impact assessment requirement for the traditional pulp and paper harvesting operations in the province. Within five years all such operations will be under this procedure, and harvesting and reforestation plans will have to be submitted for approval. The intent is to gain an overview of the operation, rather than require the operator to provide a detailed and time consuming impact statement. Monitoring programs associated with this procedure will be more a matter of compliance with the regulations rather than actual project monitoring.

Future large scale wood biomass harvesting projects in the province would likely be accommodated under this same procedure. At the present time, no approvals or compliance requirements are in place.

Large-scale harvesting of fuel peat has not yet taken place in the province. The small, short-term development at High Point Bog (Bishop's Falls) in central Newfoundland, was undertaken to demonstrate the feasibility of mining and burning fuel peat in an industrial application. Department of Environment personnel visited the site, but found nothing to warrant a monitoring program. Some fugitive dust was present during mining activity, but amounts were small and the site was 3.5 km from the nearest community. Water quality and the hydrologic régime were reviewed but studies were not undertaken because of the limited extent and short-term (summers of 1981 and 1982) nature of the mining activity.

Burning

The Department of Environment is not monitoring emissions from existing commercial or industrial wood/peat applications in Newfoundland. However, the Corner Brook, Grand Falls and Stephenville mills are carrying out in-house monitoring programs. These programs are basic ones, using an opacity meter to determine the amount of particulate matter being emitted. Other wood energy applications in the province are not being monitored in-house.

Newfoundland has the legislation to regulate, both directly and indirectly, the emissions from wood/peat applications;

maximum soot levels are set in the emissions standards guidelines, and the installation of a major wood combustion system in the province must have the system and the installation evaluated by the Department of Environment.

3.3.2 New Brunswick

Harvesting

The New Brunswick Department of Environment does not presently monitor any of the wood biomass harvesting projects in the province. Neither are the traditional pulp and paper harvesting operations monitored closely except for stream crossings; the department has a regulatory function relative to access roads crossing streams. However, a spokesman said that the continued growth of large scale and intensive harvesting of forest biomass for energy would likely result in such harvesting activity being regulated through "Environmental Impact Assessment" legislation.

At present, there are no large-scale fuel peat harvesting projects in New Brunswick. In fact, peatland inventories completed to date appear to indicate that the reserves of fuel peat in the province may not be extensive. However, regardless of the volumes available, the Department of Environment is carefully viewing the development of the industry. Before

any large-scale fuel peat mining projects would be approved, the department would require an environmental impact assessment.

Burning

The Department of Environment has no program in place to monitor the emissions from existing commercial or industrial wood/peat applications in New Brunswick. The spokesman was also unaware of any in-house environmental monitoring programs being carried out by users. However, all potential users of wood/peat biomass must apply to the department for approval (under existing regulations) of the combustion system. Cogeneration projects are similarly regulated. Emission control is the primary focus of such regulations.

Combustion of peat on a large scale is relatively new, and the department is reviewing the available data base to determine if new measures need to be taken.

3.3.3 Nova Scotia

Harvesting

The Nova Scotia Department of Environment does not monitor the wood biomass harvesting projects that are presently on-going in the province. The department usually becomes involved in

traditional pulp logging programs if proposed clear-cuts are extensive and are likely to negatively affect water quality in watersheds supplying domestic drinking water. Otherwise, even traditional logging is not closely evaluated.

Large-scale development of a peat deposit in Nova Scotia would receive attention from the Department of Environment only if disruption of a water body were to occur as a result of the development.

Burning

The department has no programs in place, and as far as is known, no in-house emissions monitoring is being carried out by users. The Federal Government is monitoring emissions from domestic combustion of wood fuel in the Truro and Lower Sackville areas, but there are no federal programs for commercial or industrial application.

3.3.4 Prince Edward Island

Harvesting/Burning

The Environment Division of the Department of Community and Cultural Affairs in Prince Edward Island administers the Environmental Protection Act which provides the mechanism for regulating activities that are potentially damaging to the environment. However, at the present time no specific

monitoring programs are in place for any commercial or industrial wood biomass harvesting or combustion project.

4. FUTURE PROSPECTS FOR WOOD/PEAT

4.1 Wood

The literature used in this study provided extensive information as to the great potential in Atlantic Canada for biomass resources.

Recently each province was required to prepare a 1984 update of Energy Supply and Demand, including Renewable Energy Resources. While there is valuable information regarding projected demand for the waste wood, there is a lack of quantitative information on the available supply of wood residues.

The literature search in the area of biomass fuel supply did not give a comprehensive overview with comparable statistics by province. Each forest management region appears to have its own set of characteristics and requires intensive reporting and review to give a definitive quantitative projection.

What appears to be required is more reporting by region or unit before reliable composite data can be summarized.

Difficulties in obtaining such data are recognized. For example, due to extensive forest lands being under private interests, reporting of such data is fragmented and requires the cooperation of many agencies and individuals.

This study did confirm that several regional surveys are in progress which, when completed, will address and quantify the supply of biomass. The importance of reliable biomass supply information is stressed. It is an important factor in determining feasibility of future bioenergy applications and to mitigate most concerns regarding long-term sustainable supply.

Each project report seemed to imply, or stated, that biomass supply was no problem. In fact, most projects to date have been initiated because a local surplus is evident. This is not to say that there aren't concerns for extended security of supply and price stability. It is recognized that the major sources for biomass fuel are dependent upon the viability of sawmills and pulp and paper industries. What happens to secondary industries having converted to biomass fuel if the primary forest-based industries fail and cheap biomass fuel is no longer available? This is a very real question today because it is known that the economic viability of certain mills in Atlantic Canada is tenuous.

Dealing with supply/demand relationships, the literature review indicates that the pulp and paper industry has the potential for energy self-sufficiency through utilization of its mill residues, supplemented by lesser quantities of forest residues. There appears to be little, if any, surplus mill residues. Conversely,

it is known that there is an extensive surplus in forest residues, contributed by pulpwood logging, diseased species and marginal or unmerchantable forest stands.

It is generally concluded that the abundant supply of biomass used to support energy conversion programs is identifiable with such woods operations. It has been suggested that this biomass should be used for fuel and that this will always be a desirable alternative to allowing it to go to waste, provided that this use is economically and ecologically justified.

There appear to be at least two possibilities for utilizing these extensive forest residues.

- (1) Encourage the pulp and paper mills to expand their wood waste burning plants to produce surplus steam and/or electricity which may be distributed to local users, district energy systems, or the power grid.
- (2) Promote harvesting and recovery programs, directing the biomass towards viable industrial/commercial/residential uses in the local area.

Considering the bioenergy demand of the pulp and paper industry as a whole, the reports indicate that most mills are well advanced in converting to wood and bark residue burning. With the primary thrust being economic viability (through reduction

of energy costs) and assisted by government programs such as F.I.R.E., with few exceptions pulp and paper operations are efficiently and economically providing their own fuel from forest and mill residues.

It is concluded from the report summaries that pulp and paper mills do not represent a strong demand for independent commercially-supplied biomass fuel because the pulp and paper operators can more effectively supply their own needs. Also, it is apparent that each mill will not pay a high enough price to the independent supplier to pay for his cost of production. This is because the mill can purchase oil in large quantities at substantial discounts thus setting a lower value on wood fuel used as oil substitute.

Assuming that the pulp and paper mills have satisfied their operational requirements by harvesting the more economic forest residues, an important question is: What to do with the large volumes of residue which remain?

Further, if the pulp and paper operators have no interest in the commercial supply of forest residue biomass from their logging operations, who should be encouraged to harvest this surplus supply?

Forest land ownership and forest management policy will be prime considerations in arriving at appropriate answers to these questions. The respective government and private agencies are currently evolving solutions and policies for specific forest regions, based upon resource economics and ecological principles. The energy potential of these forest residues, while placing demand for solutions, is recognized as a catalyst to the problem solving process.

Sawmills generally produce concentrated surplus volumes of wood residues. Depending upon the proximity to pulp and paper operations in Atlantic Canada, some portion of this material is economically used as a supplementary fuel supply to the paper mill. Sawmills which are not relatively close to such an obvious user of its residues can provide cheap fuel to other energy users. However, often such applications either do not exist or are not viable. In Nova Scotia, for example, the 1984 update identifies 25% of sawmill residue or 66,000 green tonnes per year as uncommitted surplus. New Brunswick is known to have much larger quantities of sawmill residue which has built up over the years.

One very successful application involves the district heating operation on the University of New Brunswick campus, where an assured 14 year supply of approximately 42,000 green tonnes of sawmill residue provides lower cost steam to heat several buildings.

Commercial/industrial demand represented by the report summaries involves a wide variety of applications for biomass fuel. It is evident that commercial interests can be convinced to move to biomass fuel because of the financial benefits. It is also evident from the summaries that the primary deterrent is the lack of secured fuel supply at stable price levels.

The more easily identifiable energy conversion projects in Atlantic Canada have been implemented or are nearing completion. A more challenging phase is now being addressed:

- How to integrate the remaining available biomass supply with current and future users, while maintaining economic viability, and ecological standards.

A trend is evident in the study information which indicates that progress is being made.

Forest residue supply regions are being intensively examined to permit identification and evaluation of energy user/biomass supplier combinations. Several such studies are underway in New Brunswick (Miramichi watershed, Kings/Queens Counties, etc.). Nova Scotia has identified three pilot projects which have received funding to proceed beyond feasibility. Prince Edward Island is pursuing a district heating system in Charlottetown. Newfoundland is proceeding with the integration

of waste wood supply and wood manufacturer's energy demand at Clareville.

It is recognized that each wood energy application requires intensive study and evaluation in relation to other similar activities in the local area. In this way better integration of industrial/commercial demands with biomass supply should lead to better overall management of the resource with all the inherent benefits to local industry, workers and residents.

4.1.1 Harvesting Wood Residues for Wood Energy Uses

Each successful application of wood energy utilization, as shown by a review of the project reports, is dependent upon the economic supply of wood residues.

This fact is very evident where sawmill wastes are in abundance, in close proximity to the wood boiler application. In parts of New Brunswick for example, sawdust and other mill wastes are available at trucking costs as low as \$2.75/green tonne where the equivalent energy may be valued in excess of \$35/green tonne.

Similarly, residual bark and sludge at pulp mills are valuable sources of cheap fuel which otherwise would involve costs of disposal.

The project reports and study data indicate that much is being done to harvest forest residues efficiently and economically. This is where the great potential lies in biomass utilization as alternative fuel.

On very large scales, pulp and paper industries are effectively harvesting residues from logging and diseased species. Nova Scotia Forest Industries are annually harvesting over 150,000 green tonnes of chipped slash and deadwood, and transporting it to the highly efficient wood boiler at the mill. Daily

harvest volumes of 300 green tonnes are chipped at selected woods roadsides and trucked in vans as much as 100 km to the mill. A recent report indicates that average costs for this operation are in the \$20/green tonne range.

Depending upon terrain, weather, wood stands and other factors affecting productivity and costs, the recovery of forest residues can vary dramatically. Following extensive field trials for example, Bowater's in Corner Brook project their harvesting costs at \$39/green tonne. This is where the annual production was 20,400 tonnes, an average daily production was 150 tonnes per day and the trucking distance ranged from 45 km to 80 km.

Wood chipping techniques normally applied during projects and trials covered by the report summaries included the Morbark or the Bruks equipment. Most mills have installed mechanized unloading and handling of chipped residues.

Aside from the obvious economic benefits of the cheaper than oil fuel alternatives, the chipping and removal of forest residues have a beneficial effect on silviculture and forest management. Removal of diseased and waste wood fibre has demonstrated good results in forest regeneration. It has also been demonstrated that the recovery of forest residues for

fuel generally is less costly than other forms of environmentally acceptable clearing of wastes from extensive logging operations.

The reports and study data indicate that the effective harvesting of forest biomass for small wood energy applications involves considerable study and good management. Generally, the industrial and commercial consumer of wood waste is in a position to offer considerably more per tonne for his fuel than the pulp mill, because his oil costs are more expensive. Pulp mills pay approximately \$30-\$35 per barrel compared with smaller industrial and commercial consumer costs in the \$45-\$50 per barrel range.

Generally, this permits the commercial wood supplier to charge more for his wood chips and related products.

Several very good studies and demonstration projects are represented in the reports which evaluate the financial feasibility of the commercial wood burners.

Neill and Gunter have developed relationships between the cost and production of chipped forest residues. It is concluded in Forest Residue Wood Chip Substitution Study, Phase 1, that "given the fact that 9,500 green tonnes of chips is the minimum volume required to turn a positive cash flow in year one, the

producer, once established, must strive to increase his market right from the outset if the business is to prosper and survive" (Neill and Gunter 1983). At this level the sale price of the chips must be \$50 per green tonne.

Further, at a minimum production of 2,000 green tonnes per year, a sales price of \$68/green tonne will be required to generate a positive cash flow and a 20% discounted cash flow return on investment.

As the supply of cheaper sawmill residues is used up, operators of wood fired burners must rely upon commercially supplied forest residues.

A subsequent feasibility study (Neill and Gunter 1983) evaluated the economic viability of three specific businesses in southern New Brunswick.

Based on the successful marketing of wood chip fuel to selected high oil energy uses in the local area, it was determined that the yield on investment for a wood chip supply business, a sawmill residue supply business and a fuel wood supply business would be in excess of 65%.

Forest biomass production costs were estimated to run between

\$14 to \$45 per green tonne at roadside depending upon the type of wood being chipped. To this cost must be added the transportation costs to arrive at the total unit cost per consumer contract.

The overall importance of firm contracts with industrial, commercial and institutional consumers, involving high annual volumes over 1,000 tonnes/year, is stressed.

Equally important is the availability of substantial quantities of recoverable forest residues.

Of major concern throughout a review of the project reports is the security of supply and stability of price to small consumers (under 500 tonnes/year) in more remote regions. It is very difficult for example, to model a commercial wood chip business based on the desired financial scale given by Neill and Gunther in most centres of Newfoundland.

Similar difficulties of contracted buyers are reported in parts of Nova Scotia and Prince Edward Island.

It is concluded therefore that the successful establishment of commercial harvesting and supply of forest residue as fuel requires careful study and good management.

4.1.2 Combustion of Wood Residues

Recent developments in the manufacture of wood burning boilers have dramatically improved the practicability of conversion from oil and other fuel sources.

The project report summaries and study information give extensive evidence of successful conversions.

It has been demonstrated on a large scale operator at Nova Scotia Forest Industries that bark, sludge and wastes from the pulp mill can be effectively mixed with recovered forest residues to produce steam needed for manufacture of pulp and paper. The mixed fuel with a high moisture content (in excess of 65%) can produce an average equivalent energy ratio of 1.1 bbls/green tonne. This places an averaged equivalent energy value of \$35.70 per tonne of wet biomass.

The mixing of mill bark and wood chips at the Bowater mill in Corner Brook, dramatically raises the energy equivalent from 0.55 bbls/green tonne for mill wastes alone to 0.87 bbls/green tonne for bark and chips combined.

Energy values for other wood residue fuel mixtures vary according to the species, moisture content, and boiler efficiency.

The equivalent energy value for the Scott Maritimes Mill in New Glasgow using primarily bark and minimal sawdust hog fuel is 0.82 bbls/green tonne. A similar operation at the Fraser Mill in Edmundston operates at a ratio of 1.08 bbls/green tonne.

Several reports relate how improvements have been introduced into an existing wood waste-fired boiler system to raise the efficiency of combustion.

The project reports provide extensive evidence that small burners are giving good results throughout Atlantic Canada.

Generally equivalent energy ratios ranging from 1.2 to 1.7 bbls/green tonne are being realized in industrial, commercial, and institutional applications. Considering the high cost of oil fuel to these smaller users, the savings per tonne of biomass fuel can be substantial.

Of particular interest to Canadian manufacturers is the fact that more recent burner conversions involve an increasing amount of Canadian technology. Initially, wood fired burner technology was imported from the Scandinavian suppliers.

It is concluded from these reports, therefore, that the

development of wood combustion technology in Atlantic Canada is keeping pace with the rate of conversion to wood residue fuel.

4.2 Peat

Atlantic Canada has not utilized fuel peat because other options have been available--oil, natural gas, and wood. It was less expensive to use these resources than to finance the development of fuel peat technology. But, with the recent dramatic increases in the price of oil, and because of a reluctance to depend on imported fuel, there is renewed interest in the use of peat. In 1983, Canada's first commercial fuel peat user (the Abitibi-Price Paper Mill in Grand Falls, Newfoundland) began using peat as a small (0.5%) supplement to its regular biomass fuel of bark and wood chips.

Is the Abitibi-Price development the beginning of a trend? Is it likely that peat will play a significant role in supplying the future energy needs of Atlantic Canada? Both Gosine (1980) and Wells (1980) concluded that the peatlands of Newfoundland offer potential as an alternate energy source if the economic climate and the technology are both favourable.

However, the prospects for large-scale commercial or industrial use of fuel peat do not appear to be favourable. There are a number of reasons for this. In Atlantic Canada, harvesting is a major cost. Whether the "milled peat" method or the "hydraulic mining" method is used, harvesting is still dependent on the region's uncertain climate. In a good year, 50

days of harvest may be the maximum possible (Atlantic Center for the Environment, 1981). While this production rate may be adequate for horticultural purposes, it is unlikely to meet the greater demands of a fuel peat user, who would need to invest considerable capital in machinery to harvest the total fuel requirement in such a short season.

Transportation costs for the raw fuel peat is another major factor. Peat is bulky and expensive to move. Locating the facility near the peat deposit could be a short-term solution. But peat is basically a non-renewable resource, and the resource will become exhausted after a number of years of plant operation.

Processing adds further to the cost. Direct combustion of peat requires that the moisture content be reduced from the 70-95% at harvest to about 15% (Atlantic Center for the Environment, 1981). Sun drying in the field is the cheapest way to do this, but this method is weather dependent. Mechanical drying or other pre-treatment procedures can be used, but add substantially to the processing cost.

The final major constraint is the environmental issue. Both levels of government, environmental agencies, and private companies all recognize that increased activities in peatlands

raises many concerns about the environmental cost of developing a large-scale fuel peat industry. Section 3.2.1 of this report describes in more detail the potential environmental impacts associated with peatland development.

Thus, while some countries can produce peat fuel at prices comparable with, or less than, that of oil (Finland's final product is between 60 and 70% that of oil (Atlantic Center for the Environment, 1981), their systems cannot always be duplicated elsewhere. Variations in peat, climate, cost of petroleum products, and environmental standards permit other countries to use methodologies that would not be acceptable here. If peat is to become an economically feasible energy alternative in Atlantic Canada, a system will have to be fashioned that will be specific to the needs of the region.

If such a system is developed for Atlantic Canada, it would probably be most successful if directed toward smaller-scale rather than large-scale use. Smaller industries using local peat at a moderate rate would be the most logical objective for Atlantic Canada. The 40 MW power plant recommended for New Brunswick (Atlantic Center for the Environment, 1981) appears to support this concept. Further support for the smaller facility comes from Finland where the largest of the successful peat-fired power plants in that country is 72 MW (Knight, 1981).

Should the system be found to move Atlantic Canada in the direction of small industrial/institutional users of local peat at a modest rate, the resource in each province except Prince Edward Island would clearly support the requirement for fuel peat.

A brief comment on the fuel peat resource of each province follows.

Newfoundland

Wells and Vardy (1980) estimated that there are 339 million tonnes of fuel peat in northeastern and western Newfoundland. At 40% recovery this amounts to 136 million tonnes or 100 million barrels of oil. Complete data are not available for the rest of the island, but studies at only three areas in eastern and southern Newfoundland have shown an additional 90 million tonnes of fuel peat (at 40% recovery) or 70 million barrels of oil (Wells and Vardy, 1980).

Wells and Vardy (1980) also speculate on fuel peat consumption in Newfoundland. They estimate that if there were complete conversion by the commercial/institutional/industrial sector on the island, the total annual fuel peat consumption would be 240,000 tonnes. At this rate, that portion of the fuel peat resource identified to date would last approximately 1,000 yrs.

Nova Scotia

Sizeable deposits of fuel peat have been identified in south western Nova Scotia. The estimated resource there of 90 million tonnes would yield the energy equivalent of about 70 million barrels of #6 fuel oil at 100% recovery. A more realistic figure would be in the order of 40% recovery or 28 million barrels of oil (Anderson and Broughm, 1983).

Small deposits of fuel peat have been identified in a number of other locations in Nova Scotia.

New Brunswick

Estimates of the fuel peat resource of New Brunswick (Gillies and Gemmel, 1979), with 42% of the province inventoried, indicate that there are approximately 21 million tonnes of fuel peat (at 40% recovery) which would replace 17 million barrels of oil.

Prince Edward Island

Although Prince Edward Island is known to have a horticultural peat resource, the amount of fuel peat is considered to be small.

5. SUMMARY

5.1 Wood Biomass

- a) In Atlantic Canada, a substantial volume of oil has been displaced through the use of wood biomass fuels in commercial and industrial applications.
- b) Eighty - ninety percent of the biomass consumed in the commercial/industrial sector is used by the pulp and paper industry. This biomass is mostly in the form of bark and mill wastes. In terms of supply, the pulp and paper industry is essentially self-sufficient.
- c) Pulp and paper companies leave large volumes of biomass (slash, etc.) unharvested. Harvesting this biomass would provide a silvicultural benefit to the company, and create a fuel supply for other users.
- d) Most small commercial and industrial users of wood biomass fuel face an inherent problem of security of supply and stability of price.
- e) Security of supply and stability of price may only be possible for the smaller users if user groups are located in close proximity to a contracted supplier.

- f) If the problems of fuel supply and demand can be sorted out through coordination and planning, it would appear that there is a wood biomass supply sufficient to meet the demands of the existing and proposed commercial and industrial applications in Atlantic Canada.
- g) Except for the two or three applications in which opacity of emissions is sometimes measured, environmental impact monitoring is not a feature of wood biomass harvesting or combustion in Atlantic Canada.

5.2 Peat

- a) There are only three existing or proposed projects using fuel peat in Atlantic Canada; two existing demonstration projects in Newfoundland and a proposed application for southwestern Nova Scotia.
- b) Provincial inventories have shown that each Atlantic province except Prince Edward Island has a substantial fuel peat resource.
- c) Environmental authorities are alert to the potential negative impact that large-scale harvesting of peat may have.

5.3 Recommendations

Gaps exist in many of the summary data sheets included in this report. In many cases, data could not be made available because private sector confidentiality was involved. In other instances, assessments and evaluations of various aspects of the applications have not yet been concluded. We know that a large body of information important to the future development of biomass use in Atlantic Canada will be available shortly.

We recommend that another study be commissioned in 1985 or 1986 to update the findings of this present report.

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APPENDIX 1 . INDIVIDUALS PROVIDING
INFORMATION FOR THIS
STUDY

NEWFOUNDLAND

A. B. Case
Newfoundland Forest Research Centre
Environment Canada
St. John's

R. S. van Nostrand
Newfoundland Forest Research Centre
Environment Canada

P. Graham
Department of Mines and Energy
St. John's

P. Duffett
Energy, Mines and Resources Canada
St. John's

N. Williams
Department of Environment
St. John's

L. Hulett
Department of Environment
St. John's

J. Dutton
Department of Environment
St. John's

A. Windsor
Department of Mines and Energy
St. John's

E. R. Robbins
Energy and Environment Engineer
Abitibi Price
Grand Falls

P. Hewitt
Southern Avalon Development
St. Shotts Peat Project
St. Shotts

Harvey Taylor
Abitibi Price
Grand Falls

NEWFOUNDLAND (Cont.)

R. Murley
Bowater Newfoundland Ltd.
Corner Brook

P. Lush
James Paton Memorial Hospital
Gander

B. Buggie
Department Forest Resources
and Lands
St. John's

M. Mackay
Department Forest Resources
and Lands
St. John's

Juanita Keel-Ryan
Department of Mines and Energy
St. John's

E. Blackmore
Department Forest Resources
and Lands
Gander

D. Drake
Island Energy Associates Ltd.
St. John's

NOVA SCOTIA

A. R. Anderson
Peatland Inventory Program
Department of Mines and Energy
P. O. Box 668
1690 Hollis Street
B3J 2X3

K. F. MacDonald
Section Engineer
Scott Maritimes Ltd.
P. O. Box 5490
New Glasgow, Nova Scotia
B2H 5E8

J.J. Ueffing
Scotia Farm Services Ltd.
Box 501
Kentville, Nova Scotia
B4N 3X3

D.J. Pettipas
Scotia Farm Services Ltd.
Box 501
Kentville, Nova Scotia
B4N 3X3

P. Taylor
Department of Mines and Energy
Halifax

N. Blair
Institute for Resource and
Environmental Studies
Dalhousie University
Halifax

V. Munroe
Department of Mines and Energy
Halifax

P. Burchill
Department of Mines and Energy
Halifax

B. Coulter
Department of Environment
Halifax

NOVA SCOTIA (Cont.)

C. Porter
D. Porter and Sons
Stellarton

P. Sawler
Mabou Gardens
Mabou

W. K. King
Avonport

G. Low
Lowland Farms
Aylesford

G. Gordon
Gordon's Greenhouses
Oxford

R. Wacott
Nova Scotia Forest Industries
Port Hawksbury

J. D. Hill
Scott Maritime Ltd.
New Glasgow

D. Sheehan
Canadian Keyes Fibres Inc.
Hantsport

W. Crause
Department of Environment
Port Hawksbury

NEW BRUNSWICK

T. J. Sisk
Energy Secretariat
Province of New Brunswick
Fredericton

J. D. Devlin
Neill and Gunter Ltd.
Fredericton

J. R. Dean
ADI Ltd.
Fredericton

T. Owens
Research and Productivity Council
Fredericton

D. Curtis
Department of Natural Resources
Fredericton

B. B. Meadows
Department of Natural Resources
Fredericton

P. Monti
Department of the Environment
Fredericton

G. Walsh
Maritime Forest Ranger School
Fredericton

PRINCE EDWARD ISLAND

J. DeGrace
Department of Energy and Forestry
Charlottetown

J. teRaa
Prince Edward Island Energy Corp.
Charlottetown

G. O'Connell
Energy, Mines and Resources Canada
Charlottetown

OTTAWA

R. F. Legault
Energy, Mines and Resources Canada
Ottawa

J. Robert
F.I.R.E. Office
Energy, Mines and Resources Canada
Ottawa

J. Gingras
F.I.R.E. Office
Energy, Mines and Resources Canada
Ottawa